DIVERTING WET WASTE FROM DISPOSAL: PROGRESS AND ACTION

A Report by the Ontario Strategy Team for Wet Waste Reduction

JUNE 1994

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Abstract

"Diverting Wet Wastes from Disposal" is a report of the Strategy Team for Wet Waste Reduction (STEWWR), a multi-stakeholder group comprising representatives from the composting industry, private sector, municipalities, government agencies, and public interest groups. STEWWR was assembled at the request of the Ontario Ministry of Environment and Energy (MOEE) to offer expert advice on the diversion of wet wastes from disposal and ensure affected stakeholders have an effective forum for coordinating their response to Ontario's waste management problems. In addition to participating in all stakeholder discussions, the Waste Reduction Branch of the MOEE provided administrative and support services to the Strategy Team.

The report outlines the mandate, structure and activities of STEWWR, and summarizes the current wet waste management, composting and other diversion activities practiced by the public and private sectors in Ontario. It also identifies the issues that affect the diversion of wet wastes from disposal, and contains 32 proposed Action Plans that address these concerns and maximize diversion. The strategic implementation of these Action Plans, as well as the role members of STEWWR (and other stakeholders) may play in their implementation, is discussed.

A supplement to the report contains background information on the various diversion options being implemented in Ontario and the potential for their expansion.

Appendices to the report contain: a list of relevant acronyms, a glossary of wet waste management terms, the original STEWWR Terms of Reference, a list of participating stakeholders, a list of central and mid-scale composting facilities in Ontario, background on wet waste statistics, and selected sources of wet waste diversion information.

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Acknowledgement & Disclaimer

This report was prepared by the Strategy Team for Wet Waste Reduction, a multi-stakeholder group with representatives from government, industry and environmental groups. The views and ideas expressed are those of the authors and do not necessarily reflect the policies of the Ontario Ministry of Environment and Energy. Any mention of trade names or commercial products does not constitute an endorsement or recommendation of their use.

About the Data

Comprehensive data documenting the current generation, diversion and disposal of wet wastes in Ontario has not been published. The figures and statistical analyses presented in this report are based on the best information available. Estimates are considered valid in accordance with the knowledge and experience of the members of the Strategy Team for Wet Waste Reduction. It is believed they represent an accurate picture of the wet waste management activities in Ontario.

Executive Summary

Wet wastes are different from other kinds of waste and, consequently, their diversion from disposal raises issues that are unique in the field of waste management. To begin with, everybody uses organic materials and everyone generates wet wastes: individuals, government departments and agencies, municipalities, farmers, food processors, retailers, restaurants, and other residential and industrial, commercial and institutional (IC&I) sources.

This means that the principles of waste stewardship cannot be applied in the traditional manner. Unlike the fibre and packaging industries that play a lead role in recycling, there is no single, discrete sector to take responsibility for wet waste reuse, recycling or other diversion initiatives.

In most cases, you can't "close the cycle" by returning wet wastes for treatment and reuse to those who generated them in the first place. For example, the direct recycling of trimmed carrot tops into new agricultural products is a convoluted, multi-step process requiring the coordinated efforts of a number of stakeholders.

Increasing the diversion of wet wastes from landfill will require the implementation of innovative solutions to ensure the necessary collection, storage, treatment and marketing infrastructure is in place and the associated costs are shared in an equitable manner.

"Diverting Wet Wastes from Disposal: Progress and Action" is a report of the Strategy Team for Wet Waste Reduction (STEWWR), a multi-stakeholder group comprising representatives from the composting industry, private sector, agriculture, municipalities, government departments and public interest groups. The report highlights some of the current wet waste diversion activities of the private sector, municipalities and provincial agencies, and provides direction for building on those successes.

STEWWR was assembled at the invitation of the Waste Reduction Office (WRO) of the Ontario Ministry of Environment and Energy (MOEE) to offer the expert advice of its members on the diversion of wet wastes from disposal. The objectives were to ensure that affected stakeholders have an opportunity to contribute to Ontario's long-term waste management policies, and to provide an effective forum for coordinating stakeholder response to wet waste management problems.

The mandate of STEWWR is to identify waste management issues, especially those

that affect the diversion of wet wastes from disposal, and to propose and initiate solutions. Over the past two years, the participants have:

(1) completed an assessment of wet waste management and diversion efforts in Ontario;
(2) compiled an extensive list of concerns; and
(3) created a series of "Action Plans" that address these concerns and thereby maximize the diversion of wet wastes from disposal.

"Diverting Wet Wastes from Disposal: Progress and Action" documents the mandate, structure, activities and discussions of STEWWR, including the 32 proposed Action Plans. The implementation of these Action Plans, as well as the role the STEWWR participants may play in their implementation, either independently or cooperatively, is discussed.

Stakeholders acknowledge that much of the wet waste currently going to disposal should be diverted in an economically viable, environmentally friendly manner. Unfortunately, stakeholders in both public and private sectors are experiencing unprecedented economic constraints. The resources needed to implement all of the Action Plans may not be immediately available.

The diversion options (and the associated Action Plans) which should be considered of critical importance in the short-term are those that either take a large "bite" out of the wet waste total (i.e., through on-site or central composting) or divert smaller volumes of high value materials (through primary use, animal feed and rendering options). Such efforts would utilize proven technologies, build on successful programs and systems, or otherwise embody the priorities identified by STEWWR.

To maximize the diversion and utilization of the wet waste resource base, STEWWR has suggested a select number of lead agencies that could undertake the proposed Action Plans. Lead agencies would be responsible for Action Plan implementation. For each Action Plan, additional organizations, whose efforts could support or complement the objectives of the plan, have also been identified. Lead agencies have been asked to express their commitment to complete the proposed Action Plan(s), review and refine the plan(s), and assess the external support necessary (if any).

To sustain the current momentum and cooperative spirit of the stakeholders, it is recommended that a progress meeting be scheduled for November, 1994. At this meeting, the lead agencies can report on the progress made in implementing their adopted Action Plans.

Wet waste reduction and diversion is a complex undertaking and stakeholders bring a range of divergent perspectives to the discussion. While the Action Plans have gained the consensus support of all the STEWWR stakeholders, not all of the outstanding issues important to maximizing the diversion of wet wastes from disposal have been resolved. For example, there is on-going debate on how to equitably and fairly share the cost of establishing and operating the composting and other diversion infrastructure that will be necessary. The economics of wet waste diversion varies considerably from region to region. For this reason, the preferred mix of incentives/disincentives (such as private and public sector funding, user and disposal fees) are not addressed in this report.

The activities of STEWWR has opened the lines of communication among governmental, nongovernmental, industry and municipal representatives, and allowed participants to share a wide range of views and individual experiences. Over the months of discussion and debate, stakeholders have developed a healthy respect for other perspectives on wet waste management. It is anticipated that this new spirit of cooperation will be brought to bear on any outstanding issues and these will be addressed during continuing discussions among individual stakeholders.

"Diverting Wet Wastes from Disposal: Progress and Action" reflects the commitment of the province, private sector, municipalities and other stakeholders to waste reduction. The proposed Action Plans represent feasible and practical opportunities for implementing the 3Rs and other resource recovery options. Their implementation will help maximize the diversion of wet wastes from disposal and the utilization of this valuable resource.

Chapter 1

The Strategy Team for Wet Waste Reduction (STEWWR)

1.0 Introduction

In February, 1992, the Waste Reduction Office (WRO) of the Ontario Ministry of the Environment invited a number of stakeholders in the wet waste generation, management and disposal fields to meet and offer their advice on ways to maximize the diversion of wet wastes from disposal. More than 75 representatives agreed to participate in accordance with the Terms of Reference (see Appendix D).

The Strategy Team for Wet Waste Reduction (STEWWR) represents a wide variety of both private and public groups and individuals, including: organic waste generators (from both residential and IC&I sectors), organics haulers, processors and receivers, municipalities and municipal organizations, provincial agencies, compost users, food banks, equipment manufacturers, farmers, environmental organizations and other interest groups.

1.1 STEWWR Formation and Objectives

The formation of STEWWR recognizes that the organic portion of the municipal solid waste stream, estimated to comprise 20 per cent of the combined residential and IC&I sources, is very significant. If Ontario is to meet its waste reduction targets, all opportunities for diverting this material from disposal through the 3Rs must be explored.

The STEWWR participants were asked to direct their attention primarily to diversion efforts dealing with:

(a) food products that are suitable for human consumption;
(b) biodegradable wastes that can be used to improve or maintain our natural environment by providing beneficial nutrients and/or soil amendments and so assist in animal husbandry or plant production; or
(c) wet wastes that may be used to derive biofuels.

The mission of STEWWR is to develop strategies and practical recommendations that result in the increased diversion of wet wastes from disposal. This is in keeping with the provincial objectives of reducing wastes by at least 50 per cent by the year 2000. STEWWR was asked to prepare a report that outlined its proposed plans for diverting materials from disposal (through the 3Rs of waste

management) and, further, to obtain the continued commitment of STEWWR members for the implementation of those plans.

As described in a letter to prospective participants, STEWWR was asked to:

(a) provide a forum to identify issues, concerns and solutions for environmentally and economically sustainable wet waste management systems;
(b) create a spirit of co-operation among stakeholders to further 3Rs solutions; and
(c) develop effective communications among stakeholders so that they can identify and address key issues, provide information, make recommendations and propose actions.

The STEWWR was directed to limit its deliberations to 3Rs concerns, while according waste reduction the highest priority in the hierarchy of waste management options. Incineration, landfilling and other disposal activities were not to be addressed unless they had a direct impact on the implementation of the 3Rs (by, for example, eliminating barriers or creating opportunities).

1.2 STEWWR Structure and Subgroups

To focus its efforts and maximize the contributions of its members, STEWWR created five subgroups. Each group was directed to identify the various economic, regulatory, technical, educational, and perceptual barriers that currently limit the further development of a particular diversion method. Solutions to these barriers and other opportunities are embodied in a series of Action Plans outlined in Chapter 4. The Action Plans are designed to build upon waste reduction efforts already underway and complement provincial efforts to divert solid wastes from landfill.

The following five subgroups were established:

Subgroup 1, Primary Use (i.e. the redistribution of food for human consumption)
Subgroup 2, Backyard Composting (BYC)
Subgroup 3, Mid-Scale On-Site Composting (MOC)
Subgroup 4, Direct Land Application
Subgroup 5, Central Composting

Subgroups devoted to the diversion of wet wastes into animal feed and biofuels were not established. These areas were addressed through direct consultation with key stakeholder groups. The list of STEWWR participants is located in Appendix C.

1.3 The Backyard Composting (BYC) Subgroup

The Backyard Composting (BYC) Subgroup existed prior to the formation of STEWWR. In December, 1991, in response to stakeholder concerns, the WRO established the Backyard Composting Committee to promote the continued growth and sustainability of home composting in the province. Concerned stakeholders perceived that a "levelling off" in the expansion of home composting was occurring in the province.

Methods used in 1991 to promote home composting and distribute BYC units had succeeded in reaching the portion of Ontario's population which was already aware and motivated. Stakeholders agreed that innovative and more intensive methods would be required to encourage the remainder of the population to compost. It was decided to adopt a four part framework for the Committee's activities: (i) collect and disseminate information; (ii) address technical issues; (iii) develop and undertake promotional programs; and, (iv) initiate "model" (i.e., demonstration) home composting programs.

1.4 Deliberations of the STEWWR Subgroups

Members of the other four Subgroups were asked to participate in meetings, provide input and advice on relevant issues, and undertake specific tasks (as necessary) to develop consensus on an appropriate mix of 3Rs activities. Members were encouraged to communicate to their respective stakeholder groups the results of the Subgroup meetings, as well as any action items their stakeholder group was requested to undertake. Each of the Subgroups attempted to reach consensus on wet waste issues.

Action Plans prepared by the Subgroups include a series of standard components outlining the objective(s) and specific steps to be taken to fully realize that objective. A common format was developed for presenting the proposed Action Plans, incorporating:

- a clear, self-explanatory title;
- the primary goal or objective (described in a sentence);
- a short description of the action(s) in a step-by-step format;
- the time frame for achieving each step (either in terms of time required or actual deadlines);
- the lead agency responsible for implementing the Action Plan;
- any other participating agency or agencies; and,
- any related Action Plans or other initiatives.

1.5 The STEWWR Report - "Diverting Wet Wastes from Disposal"

Producing a comprehensive, cohesive strategy document, based on the reports, lists of concerns and draft Action Plans developed by the SubGroups, was the assigned task of the STEWWR Writing Team. Draft versions of the report were circulated to all STEWWR participants and other interested parties, comments noted, and changes made. The report was intended to: document the options for organics diversion; describe the issues and barriers that affect diversion as expressed by STEWWR members; and, propose practical measures that can be implemented individually or co-operatively.

"Diverting Wet Wastes from Disposal: Progress and Action", the final report of STEWWR, is the result of these consultative efforts. The report attempts to accurately reflect the issues and concerns raised by participants, as well as the recommendations made (in the form of Action Plans) to increase the diversion of wet wastes from disposal. Wet waste reduction and diversion is a complex undertaking and stakeholders bring a range of sometimes divergent perspectives to the discussion.

The report is supplemented by a number of appendices that illustrate the extent of the diversion challenge and the success of the programs and policies that have been implemented to date. A list of acronyms and a glossary of common waste management terms are also included.

The report does not contain all the answers to the problem of diverting wet wastes from landfills and other disposal sites. Rather it provides a wide range of options, some of which may be pursued independently and others that are designed to be implemented co-operatively by two or more agencies.

As could be expected in the resolution of an issue as broad and complex as this, debate continues on the most effective ways to achieve Ontario's waste reduction targets.

The Writing Team, responsible for compiling the final report, comprised representatives from several key stakeholders and was assisted by a freelance environmental editor. Writing Team members were chosen on the basis of their key roles in managing organic waste and with consideration given to ensuring balance between the views of generators, processors and end-users.

1.6 STEWWR Achievements to Date

When this report was being completed, stakeholders had completed several of the initiatives recommended in the STEWWR Action Plans. For example, since

December, 1991, the Backyard Composting Committee has several significant accomplishments to its credit:

- The launch of model home composting projects in nine communities across the province (in the fall of 1992 and the spring of 1993);
- The model home composting program workshop (February, 1992);
- The development and distribution to municipalities of a promotional kit for home composting (spring, 1992);
- The home composting promotional supplement in Canadian Living Magazine (August 1992 issue); and
- The development of a promotional poster for home composting.

Chapter 2

The Dimensions of the Wet Waste Challenge

2.1 The Benefits of Wet Waste Diversion

This chapter provides the background material compiled by the STEWWR subgroups and Writing Team on the dimensions of the wet waste management challenge and the opportunities for diverting additional organic materials from landfill or incineration. Using this information as a basis for discussion (also see the supplement "The 3Rs of Wet Waste Diversion in Ontario" which follows Chapter 5), the participating stakeholders were able to identify those issues and concerns that may affect diversion opportunities. STEWWR then drafted a series of Action Plans to address the most pressing of these concerns and which, in turn, should serve to increase diversion rates.

Wet waste diversion requires, first of all, a fundamental shift in perception that requires stakeholders to regard every waste stream as an untapped resource. By landfilling or incinerating the food wastes, leaves and yard cuttings that comprise some 20 per cent of the combined municipal solid waste stream, we are interrupting the natural organic cycle (see Figure 1, Wet Waste and the Organics Cycle) and wasting a potentially valuable organic resource.

Rich in nitrogen, carbon, minerals and fibre, these organic materials may be either reused directly (as animal feed, for example), applied to soils to replenish their natural fertility, or composted to make a rich and fertile humus. Landfilling wet wastes also reduces the useful capacity and remaining lifespan of our operating landfills, and may create environmental problems that threaten the quality of Ontario's air, ground and surface waters, and soil.

Although representing widely varying interests and perspectives, all the STEWWR participants share at least one common viewpoint. They each support the primary objective of minimizing the amount of wet waste going to disposal. Such a stance can be justified on many grounds. Wet waste diversion:

- supports the provincial objective of decreasing solid waste disposal by 50 per cent (from the base year 1987) by the year 2000;
- protects human health from the leachates, landfill gases, incinerator emissions and other pollutants that may attend disposal operations;
- safeguards the environment from the impact of disposing millions of tonnes of wet wastes every year;
- employs diversion end-products, such as compost and animal feed, to reduce the need (as well as the environmental cost) of producing chemical

fertilizers, animal feed from virgin raw materials, etc.;
- improves the success of other solid waste recycling efforts (by reducing the contamination of "dry" recyclables, supporting integrated waste management efforts, etc.); and
- promotes resource conservation and sustainable development, hallmarks of both a healthy environment and a strong economy.

The Guiding Principles for Wet Waste Management

As adapted from the report of the Waste Reduction Advisory Committee, "Organic Waste Action Plan for Ontario" (July, 1992), wet waste management should:

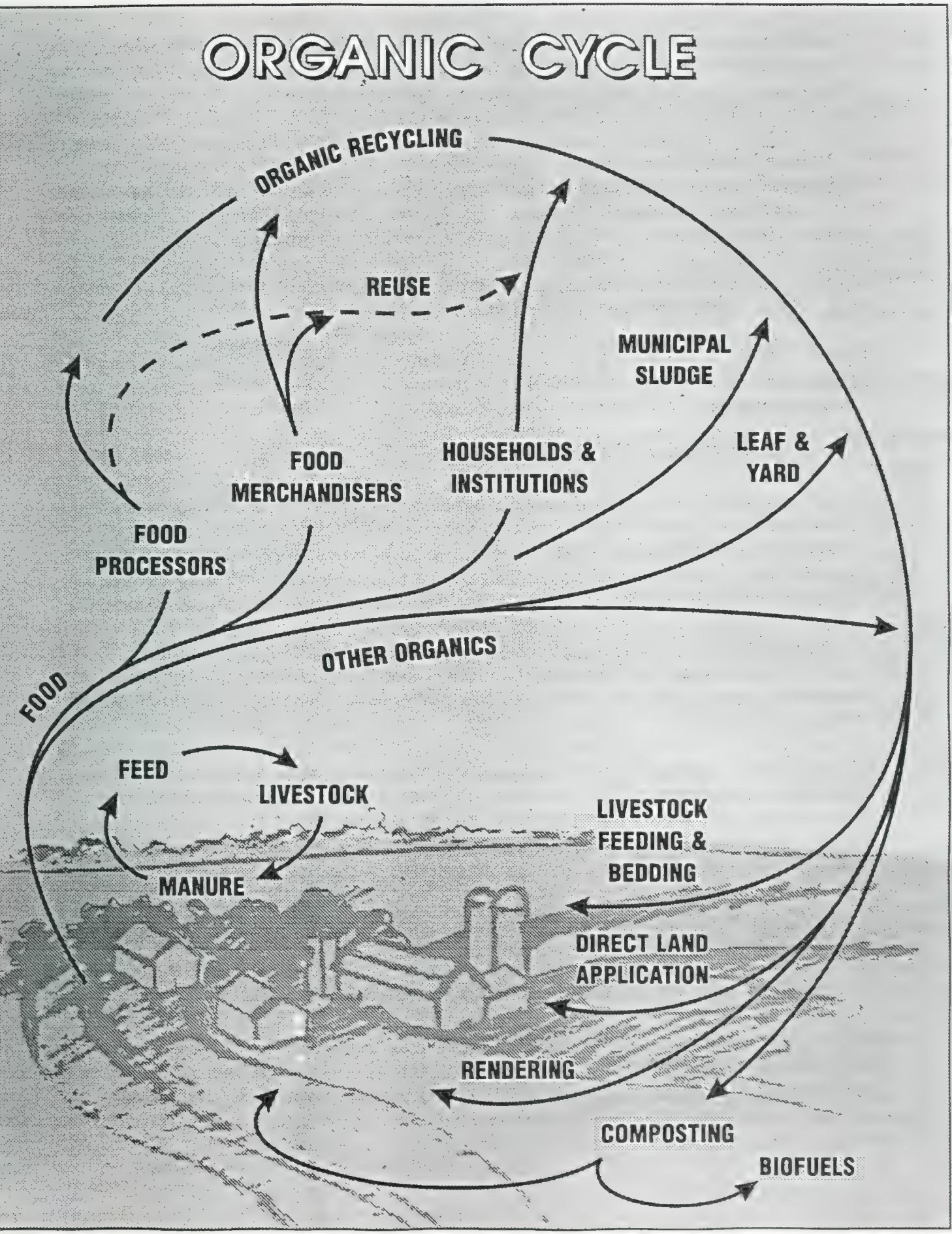
1. maximize the value of resources and the integrity of the environment;
2. integrate organic waste management with the management of all other waste streams;
3. be fair, equitable and based on the concept of resource stewardship;
4. promote personal awareness through involvement;
5. promote constant re-evaluation and innovation;
6. be practical, feasible and sustainable; and
7. be operated under the precepts of true-cost accounting.

2.2 What are "Wet Wastes"?

This document is concerned with the "wet waste" portion of the municipal solid waste (MSW) stream generated by residential, and industrial, commercial and institutional (IC&I) sources. Wet wastes are defined as wastes which are:

(a) organic in nature, edible by either humans or animals, and biodegradable or compostable;
(b) solid;
(c) categorized as either (i) leaf and yard materials or (ii) food waste comprising food originally intended for human consumption or organic by-products of the food processing, grocery product manufacturing or food service industry; and
(d) generated by residential or IC&I sources and currently sent for disposal.

FIGURE 1


ORGANIC CYCLE
ORGANIC RECYCLING
REUSE
MUNICIPAL SLUDGE
LEAF & YARD
FOOD MERCHANDISERS
HOUSEHOLDS & INSTITUTIONS
FOOD PROCESSORS
OTHER ORGANICS
FOOD
FEED
LIVESTOCK
LIVESTOCK FEEDING & BEDDING
MANURE
DIRECT LAND APPLICATION
RENDERING
COMPOSTING
BIOFUELS

These materials are also commonly referred to as "organic wastes" in that they are comprised primarily of carbon based compounds. In the context of STEWWR, "wet wastes" are defined as a sub-category of organic wastes as certain wastes were considered to be of secondary concern or beyond the scope of STEWWR discussions. Wet wastes consist primarily of leaf and yard wastes, residential and IC&I food wastes, food processing wastes and similar materials. Materials of secondary importance include: paper fibres (such as tissues, boxboard, cardboard and wood wastes) which may be compostable but not recyclable; municipal, paper mill and other sludges; and agricultural wastes such as manures.

Organic wastes beyond the scope of STEWWR discussions include diapers, used oils, PCB's, pesticides and plastic and paper scraps.

See Appendix B, "Glossary of Terms," for definitions of these materials. Discussion of these secondary wastes is limited to the context of specific programs or diversion options.

Municipal Solid Waste (MSW)

MSW are materials discarded by individuals in the course of their daily activities at home and by commercial businesses, industries and institutions as a result of normal operating activities. While there are many ways of classifying MSW, in general, and wet wastes, in particular, one of the most common is by considering the source of their generation. There are two primary sources of solid wastes:

(1) Residential solid wastes: produced by all kinds of households, including detached dwellings, row housing, condominiums and apartments (in Ontario, residential waste makes up about 40 per cent of the total municipal solid waste stream); and

(2) Industrial, Commercial and Institutional (IC&I) solid wastes: generated by industry, businesses (including shopping centres, restaurants and offices) and institutions (such as schools, hospitals and government offices). IC&I wastes comprise approximately 60 per cent of Ontario's total municipal solid waste stream.

Ontario's new 3Rs regulations define residential wastes as those collected by a municipal system.

2.3 How Much Wet Waste is Being Generated in Ontario?

Previous studies have attempted to quantify the wet wastes generated by Ontario's IC&I and residential sectors. Past work has resulted in a good understanding of the kinds and amounts of residential wet waste produced. However, comparable

information on the composition and amounts of wet waste generated by the IC&I sector is very limited. This is due to the wide spectrum of IC&I generators and, the considerable variation in waste generation rates and composition within each IC&I sector.

Attempts have been made to model the waste generation rates of specific IC&I sectors based on the standard industrial classification (SIC) system and against such information as employment, annual production rates, production or sales floor area, etc. Unfortunately, these models do not have an organics focus. No distinction is made between the major types of wet wastes, such as leaf and yard wastes, food processing wastes and prepared food wastes.

For the purpose of this report, the following generation rates have been adopted:

- 1993 residential wet waste component of MSW -- 1,300,000 tonnes
- 1993 IC&I wet waste component of MSW -- 600,000 tonnes

These totals include quantities of material being diverted (beyond 1989 diversion levels) and material going to disposal.

In addition, composting may be the most appropriate diversion option for a significant portion of the paper fibre and wood waste streams. Some fibre wastes may be contaminated and unacceptable for recycling into new consumer products, but are suitable for composting. As well, for some fibre wastes, such as tissues, there are currently no recycling options other than composting. It has been shown that these materials can be successfully composted provided that contamination can be limited.

As well, the composting process often requires the addition of amendments or "bulking agents" to ensure that the resulting recipe has the proper physical and chemical properties. Wood waste, which is free of debris and which does not contain painted wood, plywood or particle board, is often used as a bulking agent and is eventually biologically decomposed.

Available information does not permit classification of the wood waste and paper fibre streams into recyclable and compostable categories. However, it is estimated that the quantities of wet waste, plus the additional woody and fibre materials which are compostable, together could comprise as much as 35 per cent of the MSW stream.

Significant quantities of other organic wastes are currently going to landfill or incineration, including:

- municipal sewage treatment plant sludges -- annual generation is estimated

at 7 million tonnes (3-5 per cent solids), with slightly less than 6 million tonnes sent for disposal; and

- primary, secondary and de-inking sludges from paper mills -- annual generation is approximately 750,000 tonnes (50 per cent solids).

Determining the current magnitude of the wet waste portion of the MSW stream is further complicated by the distinction between quantities generated and quantities that are sent for disposal. Existing waste composition analyses are based on the material sent for disposal and do not include material that was being diverted at the time of the study. In the IC&I sector for example, large quantities of organics have traditionally been diverted to such options as rendering and animal feeding.

Of the MSW collected for disposal, approximately 20 per cent is classified as wet waste (food, leaf and yard wastes), with the remaining 80 per cent consisting of other solid wastes (such as paper & cardboard, wood, metals, glass, plastics, etc.). In 1989, the last year in which a comprehensive breakdown of MSW types and sources was compiled, Ontario's residential and IC&I solid waste generators sent some 9.4 million tonnes of MSW to landfill sites or incinerators. The wet waste component accounted for 1.88 million tonnes.

This report deals with what's left over, the wet wastes being generated by the residential and IC&I sectors that are currently going to landfills or incinerators as part of the municipal solid waste stream.

Sources of wet waste information include:
"Ontario Waste Composition Study," Volumes 1 and 2, MOEE, December 1991 (prepared by Gore and Storrie Ltd.)
"The Physical and Economic Dimensions of Municipal Solid Waste Management in Ontario," MOEE, November 1991 (prepared by CH2M-Hill Engineering Ltd.)
"Market Assessment of 3Rs Activities in Ontario," MOEE, January 1993 (prepared by RIS Ltd. and VHB Research & Consulting Inc.)

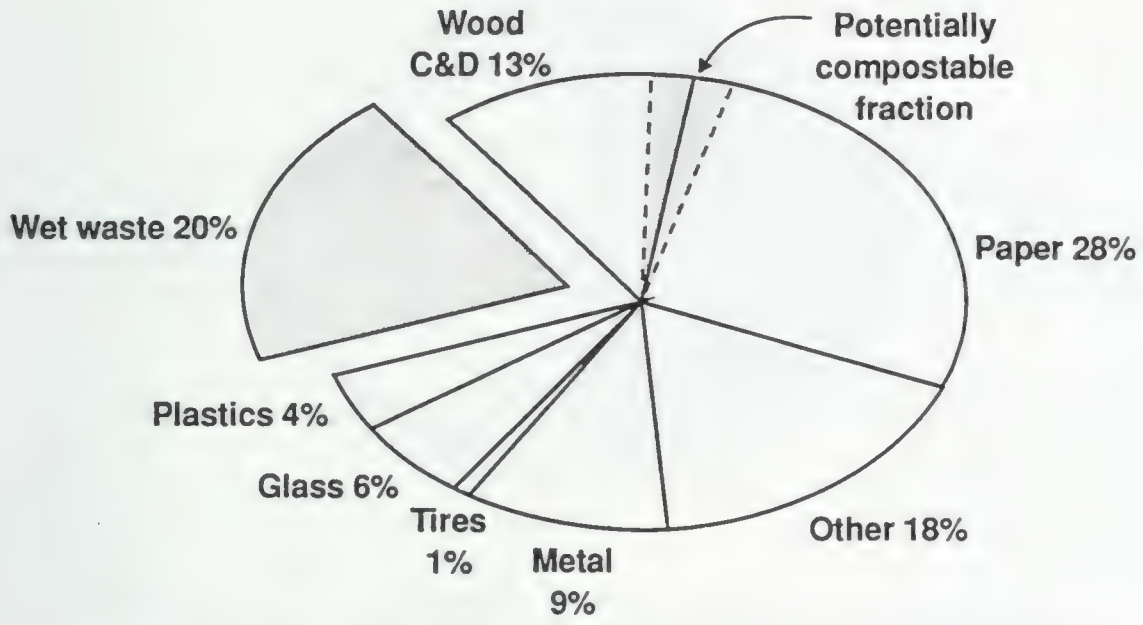
2.4 Who is Generating Ontario's Wet Wastes?

The residential sector generates the majority of the wet waste that enters the municipal waste stream. Residential wet wastes are generated by individual homeowners, multi-residential dwellings (for example, apartments) and institutions that are serviced by municipal waste collection. Residential wet wastes can be subdivided into two primary categories: (1) leaf and yard wastes, and (2) food wastes (for the purposes of this report, this category also includes "other" wet wastes, such as pet litter, sanitary products, etc). Figure 3 illustrates that these categories account for 51 per cent and 49 per cent, respectively, of the residential organic MSW stream. The "other" wet wastes, included in the food category, comprise 1-2 per cent of the total.

FIGURE 2

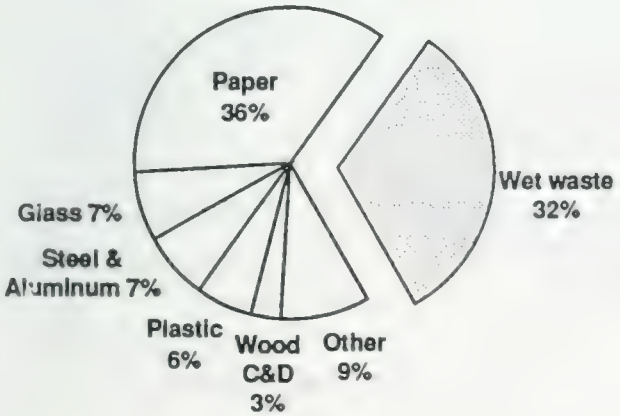
MUNICIPAL SOLID WASTE COMPOSITION IN ONTARIO,1989 (by weight)

Combined Residential and IC&I Sources

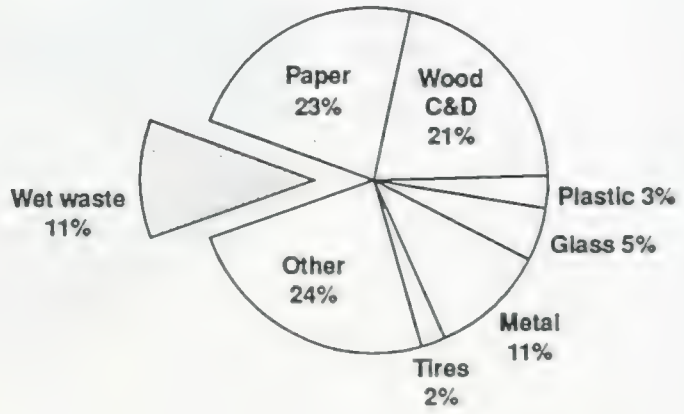


Note: Does not include some industrial wastes not normally disposed of in public landfills

Residential (42%)



IC&I (58%)

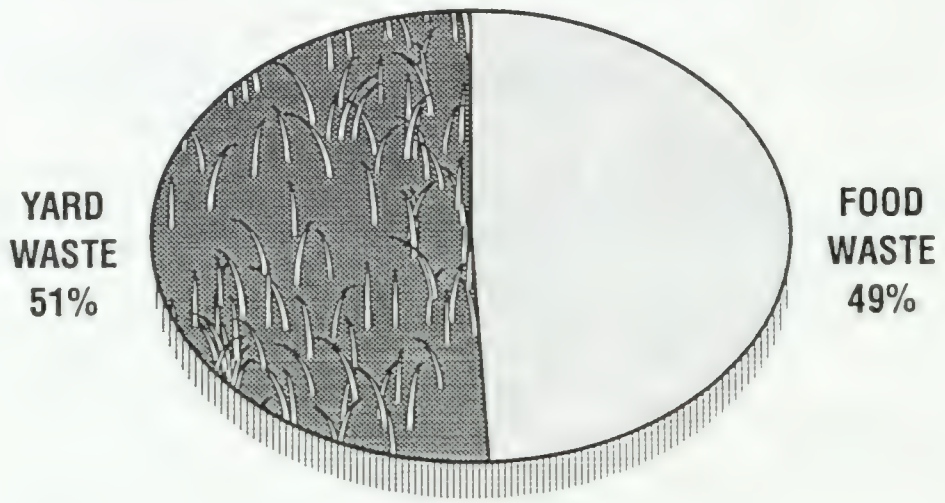


Reference: The Physical and Economic Dimensions of MSW in Ontario, 1991

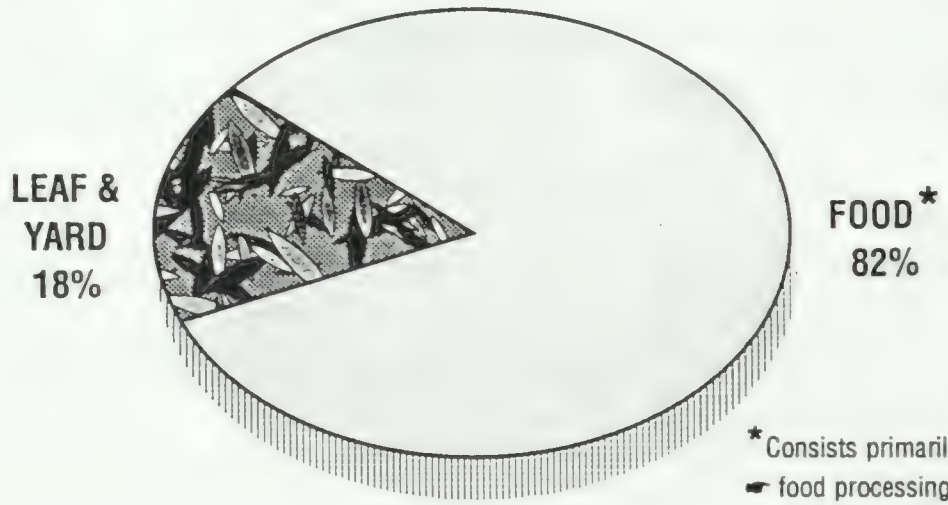
FIGURE 3

ORGANIC WASTE COMPOSITION IN ONTARIO,1989

Residential Sources



Industrial, Commercial & Institutional Sources



*Consists primarily of waste from:

- food processing
- grocery product manufacturing
- grocery product distribution
- food service

Reference: The Physical and Economic Dimensions of MSW in Ontario, 1991

The residential/municipal sector also generates a large quantity of organic material in the form of aerobic or anaerobically digested sludges from waste water treatment plants. These sludges are often suitable for land application or composting. However, they are not included in the wet waste total.

The IC&I sector generates a wider spectrum of wet wastes, including everything from grape pomace to hot dogs to dairy products. Available information permits the IC&I material to be subdivided into only two categories; food wastes, comprising 82 per cent of the wet waste total, and leaf and yard wastes, compromising the remaining 18 per cent.

The IC&I sector also generates a large quantity of organic material in the form of industrial sludges. For example, paper mills produce sludges comprised primarily of wood fibres. Depending on its individual quality, these sludges may be suitable for land application or composting. Again, such sludges are not included in the IC&I wet waste total.

Typical Types and Sources of IC&I Food Wastes:

Generators	Typical Wet Wastes
Food Processors	fruit & vegetable culls grain screenings apple pulp, grape pomace meat processing wastes
Grocery Product Manufacturers	bakery products dairy products brewers grains packaged, processed foods
Grocery Product Distribution/ Retail	fruit & vegetable culls and spoils packaged, processed foods prepared foods (deli, etc.)
Food Service (Hotel/ Restaurant)	packaged, processed foods prepared foods

2.5 Where are Our Wet Wastes Going?

There is no avoiding the fact that the majority of the wet wastes generated each year are going to landfills or some other disposal facility. Based on 1989 waste composition data and current information on management practices, 72 per cent of the residential wet wastes and 79 per cent of the IC&I wet wastes are being landfilled.

However, since 1989 there has been notable progress made in wet waste diversion. For example, where suitable alternatives to disposal exist, some food retailers are diverting up to 80 per cent of the wet wastes they generate. A partial list of diversion activities would include:

- as much as 10,000 tonnes of surplus foodstuffs that are being diverted each year to those who most need them through food banks and social service agencies;
- approximately 140,000 tonnes of residential food, leaf and yard wastes that are being mulched or composted in approximately 700,000 backyard composters that have been distributed across the province;
- more than a dozen innovative pilot mid-scale, on-site composting (MOC) programs that have begun operation;
- an estimated 30,000 tonnes of restaurant and food processing materials that are being converted into animal feed; and
- centralized composting systems and direct land application programs that are handling IC&I and municipal leaves, as well as certain IC&I food processing waste streams.

As a result of this recent activity, diversion quantities (estimated at 487,000 tonnes per year) have increased significantly over pre-1989 amounts.

But much remains to be done. The lack of 3Rs infrastructure, particularly in the area of composting, is the greatest impediment to diversion. While some IC&I generators are able to take advantage of local, off-site diversion opportunities, the majority have no viable central composting or other recycling facilities operating in their area.

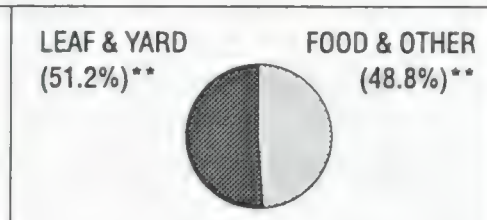
For example, of the more than 100 central composting facilities that are now operating in Ontario, only three are licensed to accept certain food waste(s). Many IC&I and residential generators, if they are unable to compost on-site, are left with no local wet waste recycling options.

FIGURE 4

RESIDENTIAL ORGANICS, CURRENT GENERATION AND MANAGEMENT

GENERATION: 422 kg/cap.* X 9.6 M pop = 4.05 Mt/y

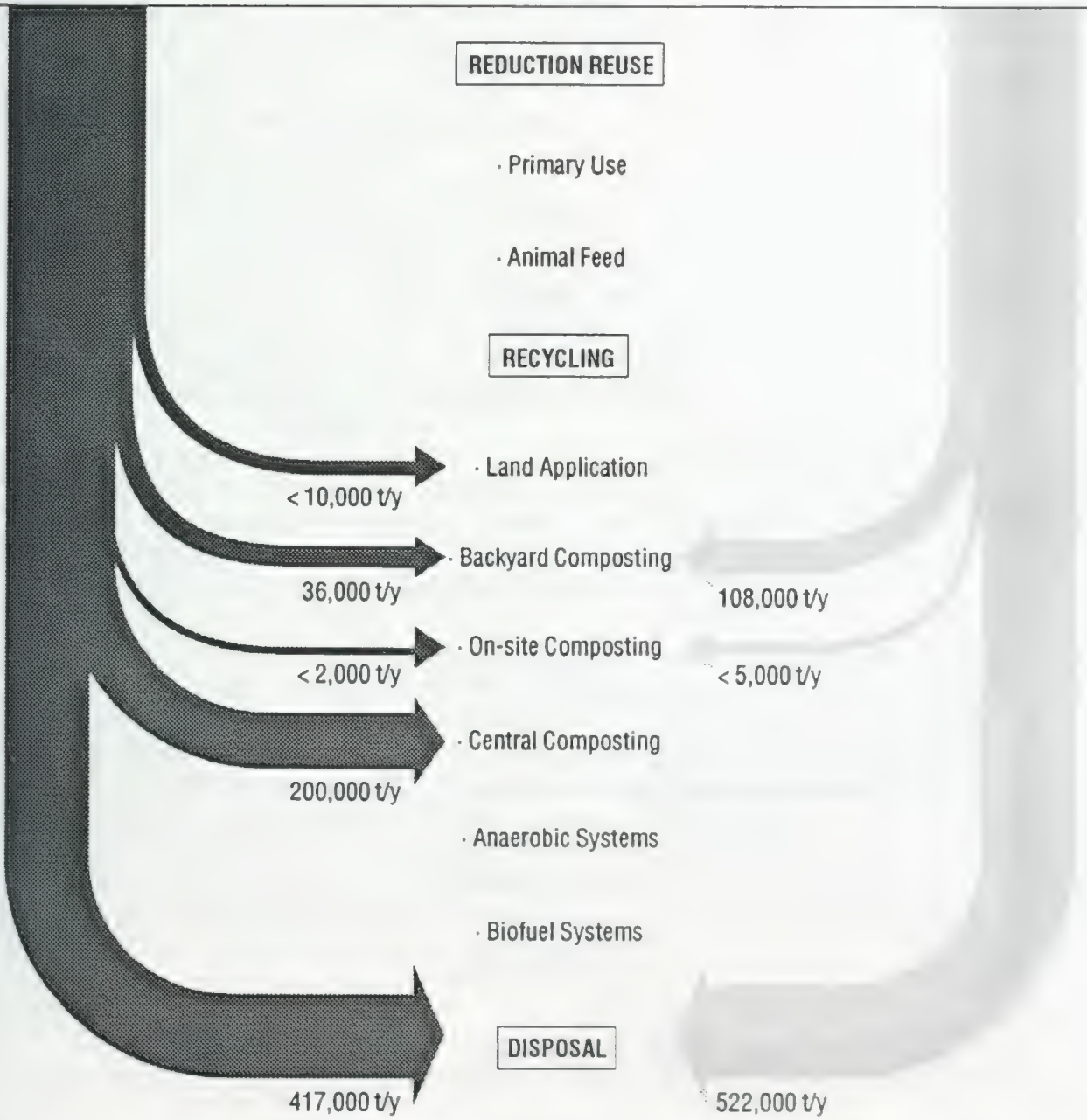
COMPOSITION: 32% Organics† = 1.3 Mt/y



LEAF & YARD: 665,000 t/y

MANAGEMENT

FOOD & OTHER: 635,000 t/y



Notes: * "Physical and Economic Dimensions of Municipal Solid Waste Management in Ontario," 1991

† ibid

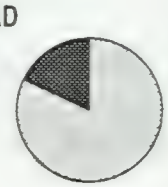
** "Market Assessment of 3R' s Activities in Ontario," 1993

FIGURE 5

IC&I ORGANICS, CURRENT GENERATION AND MANAGEMENT

GENERATION: 5.36 Mt/y*

COMPOSITION: 11% Organics† = 600,00 Mt/y



LEAF & YARD: 108,000 t/y

MANAGEMENT

FOOD: 492,000 t/y

REDUCTION REUSE

· Primary Use — 10,000 t/y

· Animal Feed — 30,000 t/y

RECYCLING

· Land Application — 20,000 t/y

· Backyard Composting

· On-site Composting — < 1,000 t/y — < 5,000 t/y

· Rendering — Data not available

· Central Composting — 50,000 t/y — < 10,000 t/y

· Anaerobic Systems

· Biofuel Systems

DISPOSAL — 57,000 t/y — 417,000 t/y

Notes: * "Physical and Economic Dimensions of Municipal Solid Waste Management in Ontario," 1991

† ibid

** "Market Assessment of 3R' s Activities in Ontario," 1993

The same situation holds true for residents who do not have access to backyard composting units (or back yards in which to place such units). While many municipalities offer collection and composting facilities for leaf and yard wastes, residents without BYC units have few diversion alternatives.

The issues, concerns and barriers surrounding 3Rs diversion opportunities are more fully discussed in Chapter 3.

2.6 The Current Regulatory Structure

(Refer to Table 1 for a summary of all relevant federal and provincial legislation).

The Environmental Protection Act

The Environmental Protection Act (EPA) is the primary legislative basis for provincial control and regulation of environmental pollution of air and water in Ontario. Part V of the EPA is concerned with waste management which is defined to include "ashes, garbage, refuse, domestic waste, industrial waste, or municipal refuse and other such wastes as are designated in the regulations." Section 9 of the Act, which regulates air emissions, may also apply to composting facilities, whether open or enclosed, and other diversion facilities.

The following types of waste are exempt from the requirements of Part V (Waste Management) of the EPA and its principal regulation (O. Regulation 347): (i) agricultural wastes, (ii) condemned or dead animals (except those that fall with the definition of pathological waste), (iii) hauled sewage, (iv) inert fill, rock fill or mine tailings from a mine, and (v) recyclable material.

All composting facilities are considered waste disposal sites under the EPA. Recently passed EPA regulations clarify the status of composting facilities in that they are not final disposal sites and therefore EPA hearings are discretionary. On-site operations, including backyard and mid-scale composting, are considered by MOEE regulators to be exempt form requiring approvals under Part V of the EPA. Section 9 approvals may still be required. On-site operations are restricted to those materials generated on-site, which includes immediately adjacent properties/facilities/housing units under the control of one owner. However, if such wastes must travel a public road or other property, the material is considered to be travelling off-site (and subject to MOEE approval).

Ontario's 3Rs Regulations

On April 29, 1993, the MOEE announced its intent to implement a set of five new

waste reduction regulations designed to divert an estimated two million tonnes of waste from Ontario's landfills each year and help realize the province's waste reduction targets. The regulations will have the largest impact on residential and IC&I dry recyclables and on packaging wastes; they will have a lesser effect on wet waste diversion.

Municipally-related regulatory provisions address: residential source separation, backyard composting and leaf and yard waste composting. IC&I provisions require: source separation programs, waste audits, waste reduction workplans, packaging audits and packaging reduction workplans.

The regulations became law on March 3, 1994. The IC&I audit and workplan provisions take effect on September 3, 1994. The IC&I source separation and recycling requirements take effect March 3, 1995, in Southern Ontario and July 1, 1996, for most sectors in Northern Ontario. And the municipal requirements take effect by January 1, 1995, except for northern municipalities which are given until July 1, 1995, to comply. The MOEE has prepared a series of guides to promote compliance with the regulations.

Compulsory Municipal Recycling Programs

Under the 3Rs regulations, all municipalities with a population of 5,000 or more must implement a municipal source separation program. Specified recyclable materials must include all of those on the basic blue box list (newsprint, and food and beverage containers made of aluminum, PET, glass or steel) and at least two materials from a supplementary list (which includes such materials as cardboard, rigid plastic containers, telephone directories, etc.). The programs must include the following components:

- collection/delivery to a recycling site (municipalities in Northern Ontario with a population between 5,000 and 15,000 may choose to establish a depot-style system),
- adequate capacity,
- a communication program,
- reasonable efforts to recycle, and
- an annual report to MOEE.

Municipalities are NOT required to include wet wastes or organic wastes in their source separation programs.

In addition, local municipalities with populations of 5,000 or more, must have home composting programs in place. A home composting program, as defined under the regulation, includes the provision of backyard composters (at cost or less) to residents. Municipalities must also publicize the availability of the program,

encourage participation, provide "how-to" information, and prepare an annual report for the MOEE.

Municipal leaf and yard composting must be established in communities of more than 5,000 residents IF they are already collecting leaf and yard waste separately, and ALL municipalities over 50,000 residents regardless if they already are collecting such materials. (If a municipality collects only Christmas trees and has a population between 5,000 and 50,000, it is not required to implement a leaf and yard waste collection system.) A leaf and yard waste recycling program must incorporate:

- adequate capacity,
- convenient access for residents,
- transportation to the composting site,
- composting/direct use on land,
- information to residents,
- reasonable efforts to make beneficial use of the compost produced, and
- an annual report to the MOEE.

The regulations streamline the approvals process for defined recycling facilities, including: a "municipal waste recycling depot," a "municipal waste recycling site," and a "leaf and yard waste composting site."

Designated depots and leaf and yard waste composting facilities are exempted from obtaining EPA approvals under Part V (Waste Management) and Section 9 (Air Emission). The regulations also allow the use of "controlled compost" in urban areas without first obtaining a Part V Certificate of Approval.

To be eligible, facilities must accept only source separated materials, employ limited types of processing, and incorporate separation buffer zones of 50 metres (recycling sites) or 100 metres (composting sites). Detailed rules in the regulations cover: records and plans; operation and design parameters; process monitoring, waste receipt, storage and processing; the control of odours, noise, dust, litter, rodents, insects, etc.; contingency planning and notification.

Compulsory IC&I Waste Auditing and Source Separation

Under the 3Rs regulations, designated large IC&I waste generators, including food processing companies and other manufacturers, retailers, schools, hospitals, construction and demolition firms, offices, restaurants and hotels, must conduct annual waste audits and waste reduction workplans that address all municipal solid wastes, including wet wastes.

In addition, generators must set up source separation and recycling programs for

designated categories of dry solid wastes. Wet wastes are not specifically designated in these diversion requirements. Currently, Ontario lacks sufficient processing capacity for this material.

Major packaging users in the food, beverage, paper and chemical manufacturing sectors and large importers are required to undertake similar packaging audits and packaging reduction workplans.

Health and Safety Concerns

Health and safety concerns are administered through the Ontario Ministry of Labour's Occupational Health and Safety Act, and its Regulations for Industrial Establishments. In the management of composting facilities, particular attention is placed on compliance with the "confined spaces" provisions of the health and safety regulations (as oxygen may be depleted in and around composting vessels or piles). Regular inoculation of employees may be required to protect against exposure to pathogenic organisms. Exposure to compost dust, which may contain endotoxins, must also be minimized.

The Impact of Local Bylaws

Local bylaws may either encourage or hinder on-site and off-site composting projects. For example, garbage bylaws that prohibit the storage of refuse may, theoretically, be used to stall larger on-site and three-bin composting operations. Property standard bylaws may contain relevant clauses dealing with control of vermin and debris, while sewer-use bylaws may impact the operation of in-vessel systems which discharge leachate to the sewage treatment system. Public health regulations may also address disease vectors, odours and other composting nuisance problems.

On the other hand, local bylaws can be used to encourage and promote waste diversion. The town of Rockland, near Ottawa, has passed a bylaw that makes it illegal to throw away leaves, grass clippings, vegetable peelings and other compostable material. Now that most residents have received free backyard or vermicomposters, the town's garbage contractor will no longer pick up compostable organics. Residents who don't comply with the bylaw face a fine of $200 to $500. Other communities are considering similar bylaws.

2.7 The Hierarchy of Wet Waste Diversion Options

Organic wastes are unique. We all generate them, and the health of the natural environment, and ultimately our well being, relies on returning them to nature. In this way we are all stewards of our organic resource and have a responsibility to help conserve the resource by aiding in its return to the system of production or

"closing the loop" in recycling terms. In the context of wet wastes, this means returning organic materials to the soil and particularly to agricultural production. Different sectors of society must be resource stewards in ways that are equitable, consistent with their primary purpose and sustainable. Stewardship roles can include supply management (ensuring that the resource is not contaminated), handling and processing, providing the economic base for the necessary infrastructure or being a market for the resulting material.

A wet waste generator who wishes to close the loop in the organics cycle has, at least theoretically, a wide selection of diversion opportunities to select. Choosing the most appropriate will require the analysis of the relevant environmental, economic, geographic, technical and business factors.

The prudent management of wet wastes incorporates the modern waste management hierarchy of environmentally-sound options (see Figure 6) and places priority on the first two "Rs" of waste reduction and waste reuse. The hierarchy reflects the need to reduce the environmental impact inherent in the generation, management and disposal of wastes.

Figure 6

The 3Rs Hierarchy of Available Wet Waste Management Options

Source Reduction Options
Reuse Options
Animal Feed
Direct Land Application
Recycling Options (On-Site)
- IC&I On-Site Composting
- Mid-scale, On-site Composting (MOC)
- BackYard Composting

Recycling Options (Off-Site)
- Rendering
- Direct Land Application
- Central Composting
- Anaerobic Digestion/Methanol Production

TABLE 1: **SUMMARY OF FEDERAL AND PROVINCIAL LEGISLATION AND GUIDELINES FOR ORGANIC WASTE DIVERSION OPTIONS**

Option		Legislation, Regulation, Guideline	Federal Provincial	Administering Agency	Relevant Aspects
Primary Use		Food and Drug Act	Federal	Health and Welfare Canada	Specifies labelling requirements for prepackaged foods.
		Health Protection and Promotion Act - Food Premise Regulation	Provincial	Ministry of Health through local public health offices	Applies to point of sale (food stores, restaurants). Specifies storage requirements for potentially hazardous foods.
		Farm Products Grades and Sales Act - Reg. 378 Fruit and Vegetable Grades	Provincial	Ontario Ministry of Agriculture and Food	Specifies quality standards for fresh produce to be sold in Ontario.
Animal Feed	direct	Health of Animals Act	Federal	Agriculture Canada	Requires registration of "garbage feeders". Specifies processing (boiling) requirements for swine and poultry operations.
	with processing	Canada Feeds Act	Federal	Agriculture Canada	Requires producer registration. Requires labelling, nutrient guarantees and quality assurances.
Land Application	All Methods	Waste sites and systems: EPA Part V - Regulation 347. Certificate of Approval as "Organic Soil Conditioning Site" required (unless specifically exempted).	Provincial	Ministry of Environment and Energy	Can specify application rate, timing of application, incorporation into the soil, testing monitoring etc.
	Ag. Lands - municipal sludge	Must conform to "Guidelines for Sewage Sludge Utilization on Agricultural Lands"	Provincial	Guideline administered by Sludge and Waste Utilization Committee (SWUC). MOEE issues Certificate of Approval	Guidelines establish quality criteria for municipal sludge (eg. metal limits) and specify application rates of aerobic and anaerobically digested sludges
	Ag. Lands - vegetable culls	EPA exemption provided under "Protocol for the Utilization of Waste Vegetables on Agricultural Lands"	Provincial		Clarifies conditions under which vegetable culls are deemed Agricultural Waste and therefore exempt from EPA Part V requirements.
	Ag. Lands- fruit culls	EPA exemption provided under "Protocol for the Utilization of Waste Vegetables on Agricultural Lands"			Clarifies conditions under which fruit culls are deemed Agricultural Waste and therefore exempt from EPA Part V requirements.
	Ag. Lands - other	Must conform to "Draft Interim Guidelines for the Utilization of Waste (Other than Sewage Sludge) on Agricultural Lands"	Provincial	Guideline administered by SWUC. SWUC makes recommendations to MOEE on individual proposals. MOEE issues Certificate of Approval	Guideline includes procedural requirements, quality criteria (metals, organic chemicals), site criteria and handling and spreading requirements.
	Non-Ag. Lands	Certificate of Approval conditions case specific.	Provincial		

Option		Legislation, Regulation, Guideline	Federal Provincial	Administering Agency	Relevant Aspects
Composting	All	Waste Sites and Systems: EPA Part V Certificates of Approval required unless specifically exempted. Air Emissions - EPA Section 9, Certificate of Approval may be required. Emissions into ground or surface waters - Ont. Water Resources Act (OWRA), Certificate of Approval may be required. Environmental Assessment Act (EAA)	Provincial	Ministry of Environment and Energy	Composting sites designated as a type of waste disposal site (processing) under EPA Part V, Regulation 347.
	On-site	Considered exempt from EPA Part V requirements.	Provincial	Ministry of Environment and Energy	Composting activities such as home composting and on-site institutional composting are considered exempt from EPA Part V. EPA Section 9 (air) Certificates of Approval may be required.
	Central	Must conform to "Guidelines for the Production and Use of Aerobic Compost in Ontario" EPA Part V Certificate of Approval Required. Section 9 (air) and OWRA may also be required. EAA required if residue requiring disposal > 200 t/d.	Provincial	Ministry of Environment and Energy	
	Leaf and Yard Waste Composting Sites	EPA 3Rs Regulations provide an exemption from EPA Part V and Section 9 (air).	Provincial	Ministry of Environment and Energy	3Rs Regulations provide an exemption for sites which: receive only leaf and yard waste, maintain the required separation distances, and operate in accordance with the conditions of the regulation. 3Rs Regulations also streamline approval for use of "Controlled Compost".
Other	Use of Finished Compost	Guidelines for the Production and Use of Aerobic Compost in Ontario	Provincial	Ministry of Environment and Energy	Guideline specifies quality criteria for finished compost (metals, organic chemicals, non-biodegradable matter, stability). Material satisfying quality criteria is deemed a "product" and is suitable for unrestricted use. Material not satisfying quality criteria is "Processed Organic Waste" and may be suitable for land application or disposal.
		Fertilizers Act	Federal	Agriculture Canada	Specifies labelling requirements for products sold as fertilizers or supplements. Also specifies metal limits for compost and other products to be sold.

Generally speaking, diversion options are arranged in the hierarchy according to the resources each requires and the attendant environmental effect of their implementation. For example, most reduction and reuse options are less energy intensive, require less infrastructure, and produce less waste than recycling options. Where circumstances permit, on-site composting may be preferable, to off-site options which require that additional energy and resources be expended on collection, transportation, bagging and de-bagging, and so on.

However, the high ranking of an option on the 3Rs hierarchy is not always indicative of its cost effectiveness or its potential to divert large quantities of wet waste from disposal. Composting, both on and off-site, has the potential for taking the biggest "bite" out of the wet wastes currently going to disposal. Direct land application is also included in the list of options that can divert large amounts of wet waste.

Smaller, but still significant amounts of wet waste can be diverted through animal feed and rendering programs. Edible food products can be conserved (and kept out of the waste stream entirely) through primary use options such as food banks and social service food redistribution efforts.

Finally, facilities must be available locally before a generator can take advantage of a number of diversion options. For example, while most IC&I and residential wet wastes can, in theory, be centrally composted, the infrastructure is not currently in place to handle more than a small amount of the wet wastes generated. Depending on the nature of the waste feedstock, conversion to animal feed, on-site, mid-scale composting or direct land application may be an appropriate alternative.

The first step in establishing a wet waste recycling program is to identify and analyze the wet waste feedstock and then match it with the most technically efficient, cost-effective and environmentally responsible treatment option. This requires answering several key questions:

- First of all, has the diversion potential of reduction and reuse options been fully maximized?
- What residual wet wastes are available for composting, direct land application, biofuels production or other recycling options?
- Does the nature of the wet wastes (for example, contamination levels, seasonal variations in quality or availability, quantity limitations, etc.) preclude any of these recycling options?
- Do regulatory controls hinder or preclude any of these recycling options?
- Do geographic/transportation considerations preclude any of these recycling options?
- Which of these wet wastes may be composted on-site, in backyard or

mid-scale composting, for instance?
- And which must be transported off-site to central composting or direct land application facilities?
- What are the short-term and long-term environmental and social implications of the various options?
- What are the short-term and long-term economic implications of the various options (including the market potential of recycled products)?

This report contains a supplement entitled "The 3Rs of Wet Waste Diversion in Ontario" which assesses and up-dates, in some depth, the primary diversion options as they are practiced in Ontario. In addition, this chapter concludes with a series of "fact sheets" that provides short descriptions of each of these options including lists of suitable and unsuitable waste feedstocks, current activities and the potential for diversion each option offers.

2.8 The Cost of Wet Waste Diversion

In the absence of regulatory requirements, further development of diversion infrastructure is dependant upon economic incentive. Economic incentive is the margin between cost of disposal (haulage and landfill tipping fee) and diversion system costs. An examination of approximate diversion option costs clearly illustrates the reason why animal feed and land application options are pressured to accept increasing quantities of material while development of central composting facilities (other than leaf and yard waste composting sites) is slower.

It is very important to note that several caveats must accompany any discussion of relative diversion/disposal costs. Chief among them is the fact that a uniform tipping fee applied to all materials disposed in a landfill is not an accurate reflection of the actual cost of burying the material. The necessary remediation measures and associated costs of managing inert materials in landfills differs greatly from similar costs of managing organics. Siting costs for facilities accepting "putrescibles" may be higher than those accepting inerts only. The cost differential can be attributed to higher capital and operating cost requirements for leachate and methane collection and management which reflect the generation of these products from the decomposition of wet wastes.

The cost of diverting a tonne of wet waste can vary by as much as two orders of magnitude depending on the type of waste and access to local infrastructure. The difference in cost between diversion options generally reflects:

- inherent difficulty in managing material (eg. "clean" waste to animal feed vs. mixed wet waste to central composting),
- market value of end product,
- environmental protection requirements, and

- land and technology investment.

As well, costs of a particular option can vary significantly. The range of cost within a diversion option generally reflects:

- economies of scale,
- level of development of technology,
- environmental protection requirements, generally related to magnitude and location of undertaking, and
- proximity to major generators.

Figure 7 provides a limited view of the range of relative costs of wet waste diversion options in Ontario. A more complete cost assessment is not possible given the limited amount of data available. Where no data was available, industry estimates were used. Supporting information for Figure 7 is presented in Appendix E. A brief discussion of the cost components associated with each option follows.

Animal Feed

The cost of animal feeding is taken as the cost to the waste generator for collection and transportation. Lower fees generally represent a long established relationship between generator and user where the nutrient value of the waste compensates the user for collection, transportation and on-farm handling.

Many livestock operations in close proximity to large urban centres have been receiving food wastes for a number of years. This option is very competitive with current disposal fees although only a small portion of wet wastes are suitable. As the pressure to divert wet wastes to animal feed grows, available capacity will be located increasingly further from urban centres. The cost of this option is expected to rise due to increasing transportation costs and an increasing supply of wastes.

Direct Land Application

Available cost information is limited to the application of municipal sewage sludge. Similar cost information for land application programs involving paper mill sludge, fruit and vegetable culls and other processed organic wastes is not readily available.

The low per tonne cost of sludge spreading reflects the relative ease of handling and the density of this material (3 - 5% solids). However, the cost does not reflect the effort required to obtain owner and MOEE approval. It does not reflect the seasonal limitations of land application and the related requirements for storage. As well, not all municipal sludges are suitable for land application due to contamination.

Rendering

Cost of rendering is taken as the tipping fees at the rendering facility. Tipping fees depend primarily on waste type. Wastes of value to the rendering process, such as meats, oils and greases, are tipped at a lower rate. Other high moisture materials, such as vegetable wastes, incur higher fees.

Competition with disposal has resulted in excess capacity within the rendering industry.

Backyard Composting

The cost of backyard composting is taken as the cost to the municipal program operators and includes capital and operational components. Capital costs are related to the provision of composting bins. Ongoing operational costs are incurred through bin distribution, promotional programs, support (workshops, hotlines) and monitoring (visits, surveys). The range in costs reflects variability in householder participation rates (in that somewhat less then 100% of those receiving composters will participate on an ongoing basis) and different patterns of wet waste generation depending on the number of people in the household, the size of the yard, trees etc.

IC&I On-site Composting

Cost information for on-site composting programs is available for several projects underway at government facilities that were sponsored by Management Board Secretariat. These projects employ either windrow or aerated static pile methods. Processing capacities are typically less than 100 tonnes annually with the resulting compost being used on-site in agricultural operations.

Capital cost components include site preparation and equipment such as loaders and manure spreaders. Operational costs generally include labour only. Costs do not reflect avoided disposal or other management fees. As well, costs do not reflect the value of the compost product.

The range of reported costs appears to reflect the processing capacity with the smaller operations reporting the highest per-tonne cost. The per-tonne costs reported for smaller facilities may be influenced by the difficulty in allocating an appropriate portion of the overall operational cost of a facility to such a minor activity.

Although several mid-scale systems are available for on-site applications, there is no cost information on private sector applications.

Municipal Leaf and Yard Waste Composting

Capital cost components include site preparation (artificial base, drainage, runoff collection pond, fencing etc.) and equipment such as loaders, compost turners, screens etc. In many cases, municipalities are able to utilize existing equipment or lease or rent equipment as necessary. Operational cost components include labour, maintenance, insurance etc. Collection costs are not included.

Information is available for sites with capacities in the range of 1,000 to 4,500 tonnes annually. Typically there are economies of scale.

In the past, the resulting compost product was provided to residents free of charge. Therefore no revenue is included.

In-Vessel Composting

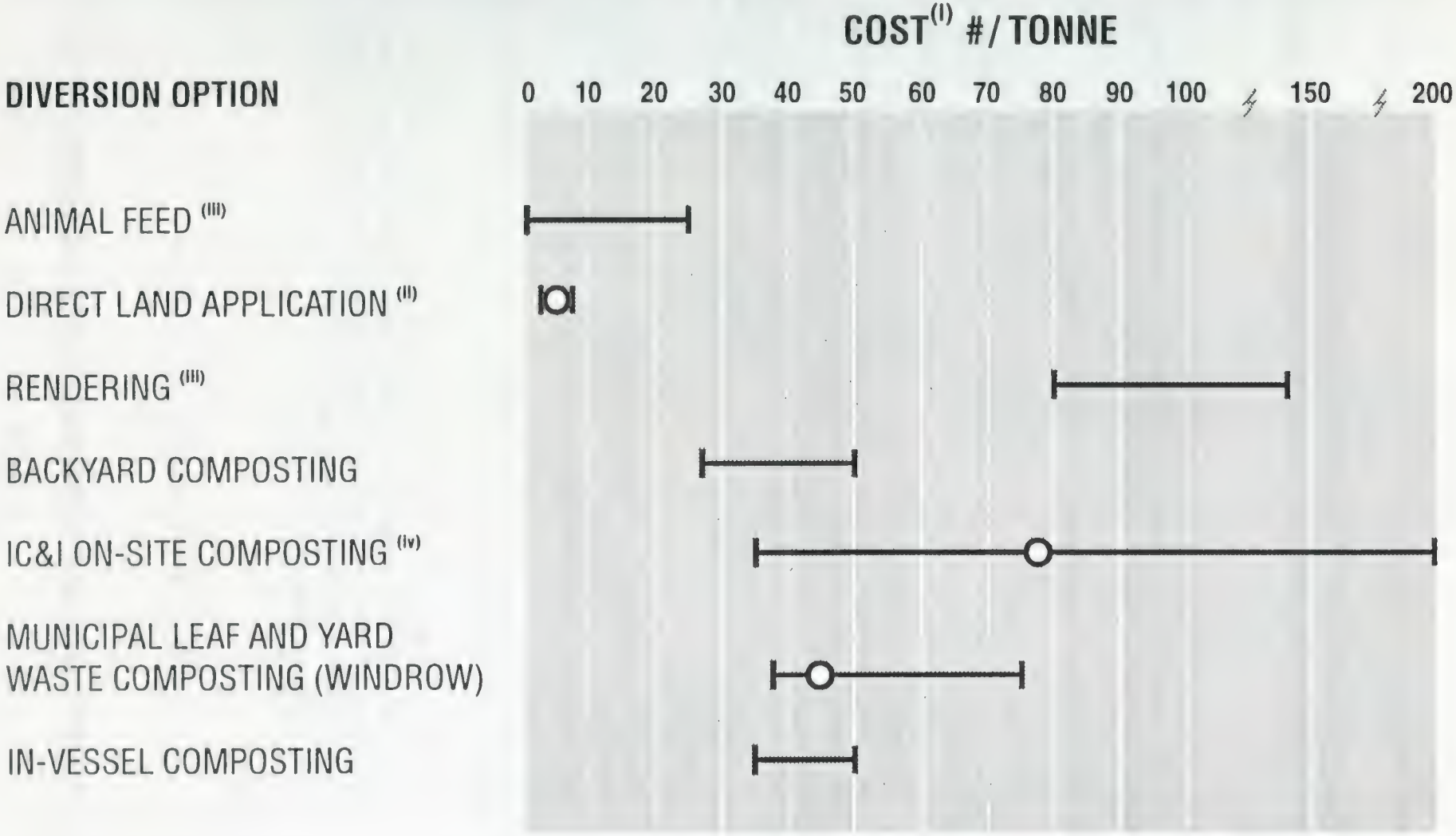
In-vessel systems generally require less land and more investment in technology than windrow systems. Per-tonne operational costs for in-vessel facilities may be less than for windrow operations due to the reduced labour requirement. Collection costs have not been included.

Information on in-vessel system costs in Ontario is limited. There are currently only two in-vessel centralized composting facilities in the province. One facility processes approximately 9,000 tonnes annually. Preliminary information exists for a planned facility with an annual capacity of 40,000 tonnes. This limited data may not accurately reflect the true range of costs for in-vessel systems.

The overall cost of in-vessel systems reflects economies of scale. However, it is unlikely that scale, or manipulation of other factors, could reduce system costs to the point at which in-vessel composting can compete with current disposal fees.

FIGURE 7

RELATIVE COSTS OF DIVERSION OPTIONS



NOTES

(I) Costs = per tonne capacity capital costs amortized 10 years (where appropriate) + annual per tonne operating costs. Capital costs for facilities do not include land. Operational costs for central composting does not include collection.

(II) Municipal sludge only. (III) Cost taken as tipping fee to generator. (IV) Does not include multi-unit residential.

KEY

Range of available data.

'O' indicates median value.

FACT SHEET #1: Food Waste Reduction

Description

Reduction involves activities that decrease or eliminate the production of wastes. Changes in the production process or consumer practices can decrease the consumption of materials and/or the quantity of waste produced.

Consumers can help reduce waste by considering the following factors:

- Purchasing: planning for the purchase and buying only what can be consumed before it goes bad; selecting the produce that will keep the longest.

- Storage: identifying and using the best storage facilities for each type of food; providing proper maintenance for the storage facilities (ie. freezers); using the food in storage before its expiry date.

- Menu planning: understanding the requirements and taste preferences of the people who will be eating the food; finding out the number of people who will be eating; estimating the size of the meal that will be consumed.

- Post-Meal planning: deciding on the best way to properly package (ie. foil, plastic containers) and store the leftover food (ie. freezer, refrigerator); using the leftovers before they go bad.

Organizations in the IC&I sector can help reduce waste by considering the above factors as well as the following:

- Conducting research: developing new produce varieties that last longer and can endure traditional transportation and storage conditions; developing preferable transportation/storage conditions; developing new harvesting/processing technologies that decrease byproducts; developing new products from byproducts.

Suitable organics

All food materials (vegetables, fruits, grains, fish and meats).

Unsuitable organics

There are no unsuitable organics, but individual food categories should be understood with respect to their unique properties.

Current activity

Reduction activity is difficult to measure. Consumers and organizations in the IC&I sector are already reducing waste because it results in lower costs. The food processing industry has a waste/byproduct rate of five per cent in certain sectors (ie. vegetable processing).

Who is currently involved?

Residents and organizations in the IC&I sector such as the food processing industry and food service facilities (ie. restaurants, grocery stores, hospitals, prisons, etc.). Processors/handlers and end-users are not currently involved.

Potential for diversion

The potential in the commercial, institutional and residential sectors is unknown and needs to be determined.

FACT SHEET #2: Leaf & Yard Waste Reduction & Reuse

Description

Leaf and yard wastes are generated seasonally by the mowing, pruning, raking and gardening activities required to manage the vegetation surrounding residences and other buildings, parks, playgrounds etc. Reduction and reuse activities are aimed at reducing the quantity of this material that must be managed as waste.

Reduction of leaf & yard waste by not growing plants or trees will reduce the quality of life. Reducing the production of grass clippings can be achieved through more controlled use of fertilizers on lawns or use of alternative ground covers that do not require clipping. Direct reuse includes leaving grass clippings on the lawn (ie. grasscycling) and use of leaves as mulch. Alternative landscape management practices include: selecting low maintenance plant species, special maintenance techniques (fertilization, watering trimming etc.) and specialized equipment (eg. mulching mowers). Two recent trends in landscape design are "Xeriscaping" which is an approach to minimizing water requirements and "naturalization" which refers to an overall conservation objective.

Suitable Organics

Leaf and yard waste as defined in the 3Rs Regulations includes; leaves, grass clippings, tree and shrub trimmings, fruits and vegetables from gardens, flowers, natural Christmas trees and similar organic materials generated from gardening and yard maintenance activities. Quantities generated will vary depending on the season. Grassy materials and yard trimmings start in the late spring and last through the summer. Leaves start in the early fall. Woody materials may also be prevalent in winter because of high winds and ice storms.

Current Activity

Reduction is always hard to measure. Many municipalities have, or are in the process of establishing, grasscycling programs.

Who is Currently Involved

Generators include residences and IC&I sector establishments with landscaped areas. Landscaped areas surrounding businesses, industries, institutions and multi-residential

housing (apartments, condominiums) are usually managed by landscape contractors.

Potential for Diversion

Needs to be determined. Possible ways we can do this is by conducting pilots and documenting opportunities for reduction on a case by case basis at different projects sites throughout Ontario.

FACT SHEET #3: Primary Use

Description

Primary Use is the redistribution of surplus food, in its original form, for human consumption. The main objective of Primary Use programs is to provide safe and nutritious foods to needy individuals. A major source of food for Primary Use programs is surplus food from the agricultural, food processing, grocery product manufacturer and distributors, and the foodservice industries. Primary Use systems divert to a beneficial use some foods that would otherwise be discarded.

The Primary Use system is maintained by not for profit organizations that operate at the national, regional and local levels. Activities at the national level include sourcing food from large corporate donors, obtaining transportation services and managing the distribution of food to regional and local food banks with warehouse capability. Regional and local primary use agencies source food donations locally, store and repackage foods into individual food hampers.

Primary Use agencies serve basically two types of clients: emergency users such as food banks and supplemental users such as community service shelters, residences, missions etc.

Suitable Organics

Foods redistributed through primary use systems typically include:

Fresh Produce
- fruit and vegetable culls
- gleaned fruits and vegetables

Prepackaged or Bulk Processed Foods
- stale dated foods ie. approaching the "Best Before" date
- food which are off-spec. in non-critical areas such as colour, shape, granulation and packaging
- product returns and process overruns
- incorrectly labelled products

Prepared Foods
- surplus prepared meals from hotels, banquet facilities, caterers etc.

Unsuitable Organics

The suitability of particular foods can be determined by the following criteria:

- type of food
- condition of the food at time of availability
- capability of primary use system to maintain quality
- compliance with health and labelling regulations

Current Activity

Comprehensive information on the quantities of food products redistributed through the Primary Use system which otherwise would have been discarded does not exist.

The Canadian Association of Food Banks estimates that annually the Primary Use system distributes 100 million pounds of food (approx. 45,000 tonnes) nationally. On a proportional basis, Ontario contributes approx. 9,000 - 15,000 tonnes of this total.

Who is Currently Involved

Donors	Processors/Handlers	Users
◦ Grocery product manufacturers ◦ Grocery product distributors/retailers ◦ Foodservice Industry (both large corporations and local businesses)	◦ National: Canadian Association of Foodbanks ◦ Regional: Daily Bread Foodbank etc. ◦ Local: foodbanks, "Second Harvest" type operations. ◦ Transportation: volunteered	◦ Foodbanks ◦ Social service organizations including residences, shelters, missions, drop-in centres etc.

Potential for Diversion

Many stakeholders in the Primary Use Subgroup support the implementation of GFDL to protect current and encourage additional donations.

The potential of the Primary Use system to divert food from disposal is constrained by: limited types and quantities of foods available for donation, limited access to transportation/handling services, and assurance of/responsibility for maintaining food quality. While the social benefit may be great, the potential for increased diversion of organic wastes through this option is relatively small.

FACT SHEET #4: Using Food Wastes as Animal Feed

Description

Traditionally, certain by-products from commercial food production have been utilized by farmers as feed or feed supplements for swine, cattle or poultry. The relationship between generator and user has been direct, based on economic incentives and the use of quality food waste supplies.

There are three basic approaches to utilizing food wastes as animal feed:

- the direct feeding of culled produce and other suitable material to cattle
- on-farm processing (ie. boiling) of food before it is fed to swine or poultry
- commercial processing of wastes to produce a dry feed supplement

Agriculture Canada regulates the feeding of organic waste to swine and poultry under the Health of Animals Act.

Suitable Organics

Suitability is dependant upon economic (nutrient value and displacement of other feeds) and biological (palatability, lack of harmful constituents) factors.
Common organic waste types are listed in order of generally decreasing suitability as animal feeds.

High suitability		Low suitability		
Dry Manufacturing	Wet Manufacturing	Food Processing	Packaging Culls	Post Consumer
oil meals, pastas, bakery products	dairy, brewers grains, distillation products	vegetable canning wastes	whole raw vegetable	restaurant, hotel

Current Activity

Comprehensive data on quantities and types or organics diverted through this option are not available, however annual quantities are estimated to be approx. 30,000 tonnes. Pressure to divert food wastes through this option is increasing, especially in areas close to food processing/manufacturing operations or high population densities and areas with high landfill tipping fees.

Who is Currently Involved

Generators	Processors/Handlers	End Users
◦ food processors ◦ food distributors & retailers ◦ foodservice (restaurants, hotels)	◦ farmers ◦ waste management companies	◦ farmers (cattle, swine & poultry producers)

Potential for Diversion

There is generally a strong demand for high nutrient value wastes (eg. oil meals). Cattle and pig farmers may pay between 30-50% of the cost of conventional feed to suppliers of acceptable food waste alternatives. For lower value wastes, farmers may pick up the material at no cost to the generator or they may charge the generator for removal.

The potential exists to divert a large additional amount of food waste to animal applications. The ultimate diversion potential is constrained by:

- livestock population - affected by market demand for animal products
- biological factors - suitability of wastes (nutrition, consistency)
- economic factors - value of waste relative to normal feeds, landfill tipping fees, cost of others options
- physical factors - proximity of generator-farmer on-farm handling ability

FACT SHEET #5: Direct Land Application of Wastes

Description

Direct land application of wet wastes is the practice of incorporating suitable organic wastes into agricultural and other lands to improve soil fertility. In some cases the waste materials are temporarily stored before spreading and working in, or injecting them on or in the upper 15-20 centimetres of the soil. This system is one of the simplest biological treatment methods available and relies upon the natural soil micro organisms to break down the organic wastes.

The main feature of this option is its low cost because wastes do not have to be treated or stored for long periods before being utilized. Wastes can only be applied at times when there is minimal damage to soil or growing crops. Seasonal factors such as crop growth and weather limit access to this option.

The major attraction of direct land application is the addition of organic matter to the soil. Plant nutrients may also be released over time. It results in increased soil microbiological activity that occurs during the transformation of the organic wastes into beneficial nutrients and other materials for the soil ecosystem.

Other potential applications are in land reclamation and forest related uses where substantial quantities can be used to restore soil productivity.

Suitable Organics

The suitability of an organic waste stream for direct land application depends upon its innate benefits to crop production, the concentrations of heavy metals and other contaminants, the potential for producing objectionable odours and freedom from pathogens and weed seeds. Suitable materials that are currently being applied to land include:

- treated municipal sewage sludge
- wood, pulp, and paper fibre wastes
- leaf and yard wastes
- dairy and poultry processing wastes
- lime wastes from manufacturing processes
- culled fruits and vegetables
- food processing industry wastes

Current Activity

The direct land application of wastes is scattered widely across the province and is affected by the seasonal availability of wastes, weather and soil conditions, and the availability of land close to the site of the waste generator. The amount of activity varies and at best can only be estimated. Of the approximate 7 million cubic meters of municipal sewage sludge generated in the province, 1.2 million cubic meters are applied to land, with the remainder incinerated or sent to landfill.

- land application sites regulated by MOEE as "Organic Soil Conditioning Sites"

- guidelines available:

    - "Guidelines for Sewage Sludge Utilization on Agricultural Land"
    - "Interim Guidelines for Wastes Other than Sewage Sludge"

- proposals for application of "other" wastes are assessed for suitability by the interministry and interagency Sludge and Waste Utilization Committee.

Who is Currently Involved

Typical generators and suitable waste types include:

- municipalities - sewage sludge and leaf and yard wastes.
- food processing - seasonal cull vegetables, fruits, plant material
- treated wastes from dairy and poultry processing plants
- recyclers of paper and wood products - sludges and paper and wood fibre material

Private and municipal sludge haulers deliver and spread organic wastes on agricultural land. Some farmers are equipped to haul wastes directly to their fields.
Farmers utilize the majority of wet organic wastes on their farms as a source of plant nutrients and as a supplement to replenish soil organic matter levels.

Potential for Diversion

The future for direct land application of wastes depends on several factors including:

- assurance of waste quality and consistency
- addressing public concerns
- addressing soil compaction and winter spreading issues
- seasonal storage requirements for some wastes
- competition for wastes for other uses such as composting or thermal processing

FACT SHEET #6: Rendering

Description

Rendering is a process whereby organic wastes are reprocessed into value added products including tallow and bone meal. The rendering process involves "cooking" the wastes under high temperature and pressure conditions. Bone meal is used as a livestock feed supplement. Tallow is a hardened fat and is used to produce soaps and other toiletries.

Suitable organic wastes have been diverted from disposal through rendering for many years. Therefore, quantities sent to rendering are not included in current waste generation studies.

Suitable Organics

The rendering process accepts virtually all organic wastes. However, preferred wastes are those from which the greatest value of end product can be derived.

Preferred Organics	Acceptable Organics
◦ meat/poultry/fish processing wastes ◦ fats, oils, greases	◦ single source food wastes (eg. food processing wastes) ◦ mixed food wastes

Current Activity

Comprehensive information on the quantities of wet wastes diverted through rendering is not available.

Who is Currently Involved

Generators	Collectors/handlers	Processors
◦ meat/poultry/fish processors ◦ oils/greases from foodservice industry	◦ private waste management companies	◦ approx. 6 rendering facilities in Ont. (1)(2) ◦ none within the GTA

(1) 3 independent facilities
3 associated with packing plants (will not take from outside source)
(2) also one facility in Winnipeg and one in Montreal

Potential for Diversion

Currently, rendering operations have excess processing capacity.

The potential to increase diversion through this option is constrained by waste suitability and overall system economics. Markets for products are well established and provide $200 - $300 a tonne per product. Rendering must compete with disposal costs. Required tipping fees are $90 - $150 a tonne depending on the type of waste (ie. preferred customers have the lowest tipping fees), also depends on quantity, whether collected or delivered, frequency etc.

FACT SHEET #7: Backyard Composting

Description

Backyard composting activity in Ontario has two components:

- participation of individual households: who compost suitable household organics in their backyards either in commercial units or in open piles, and

- municipal BYC programs: widespread household participation in BYC is achieved through coordinated municipal programs. Municipal BYC programs consist of the following components:

    - provision of BYC units
    - provision of promotional/educational info
    - ongoing support
    - program monitoring

Experience has shown that approximately 20 percent of single family households are self motivated to participate in home composting. Participation in municipal BYC programs of 70 percent and greater have been achieved through innovative and intensive distribution and promotion schemes.

The Recycling Council of Ontario (RCO) has developed training courses for residents (Master Composter Training) and program staff.

To be a viable diversion option in the long term, it must be recognized that BYC programs require periodic maintenance in the form of participation, monitoring and householder outreach and support.

Suitable Organics

About three quarters of the waste generated by householders can be composted at home. All fruit and vegetable peelings, tea and coffee grounds, unbleached paper towels and coffee filters, hair and bread.

Yard waste, such as leaves, plants, brush and hedge trimmings are also accepted. Grass clippings can also be composted but they should be dry and placed in thin layers.

Unsuitable Organics

Organic wastes that are protein-based, such as meat, fish, bones, butter or milk.

Current Activity

The government's 3Rs regulations require all municipalities with 5,000 or more residents to have a backyard composting program in place. As well, municipalities now have explicit powers to charge user fees for waste collection which if exercised, have been shown to encourage BYC. As of January 1994, over 700,000 home composting bins had been distributed through BYC programs in 530 municipalities.

Who is Currently Involved

- Single family households
- Municipalities - program responsibility
- Interest groups - RCO, Association of Municipal Recycling Coordinators, local volunteer/community groups provide information and other resources
- MOEE - funding, information

Potential for Diversion

On average, participating households can divert 150 to 240 kg of waste annually through backyard composting. The potential to increase diversion of residential wet wastes through BYC is very large. Factors which could limit the ultimate diversion through BYC include:

- householder acceptance
- numbers of households without opportunity (eg. in dense, high rise urban areas)
- waste suitability

FACT SHEET #8: Vermicomposting

Description

Vermicomposting is the biological degradation of organic matter using earthworm biotechnology. Vermicomposting or 'composting with worms' is not true composting as organics are not degraded aerobically but within the digestive tract of earthworms.

Earthworms can consume and excrete their body weight each day. The excretion is known as a casting. Castings are ready to use as a high nutrient natural plant food. Castings are a finished product, will not heat, or burn plant roots. Volume reduction can be up to 90 percent. Vermicomposting can be accomplished in "static pile" conditions as the worms naturally aerate the material.

Suitable Organics

Examples of suitable feedstocks for vermiculture include:

- Vegetables
- Fruits
- Leaves
- Grass
- Meat
- Fish
- Organic oils
- Sludge
- Cardboard
- Paper
- Hair
- Organic Cloth

Current Activity

Potentially vermicomposting is applicable to all scales of operation.

Small scale - household indoor bins or outdoor insulated units that are fed manually
- unit capacities are normally 0.5 to 10 kg per day.

Mid-scale - typical capacities range from 25 kg to several tonnes per day
- on-site in-vessel systems providing for shredding and control of temperature, moisture and ventilation

Large scale - centralized facilities that vermicompost 30 to 50 tonnes per day

Who is Currently Involved

The majority of vermicomposters in use are the household variety.

Mid-scale, on-site vermicomposting is relatively new and present users in Ontario are a restaurant, a commercial area which compost about 50 lbs per day, and a provincial hospital.

There are currently no large scale facilities in North America.

Potential for Diversion

Vermicomposting is emerging as an on-site option for some commercial and institutional generators.

The potential for increased diversion of organics through this option is currently limited by lack of information in the following areas:

- process control of medium to large scale facilities
- cost comparison with other options especially aerobic composting

The market for large quantities of worm castings is also unknown and concerns regarding product quality in the areas of metal concentrations (due to volume reduction) and potential pathogen content (due to lack of high process temperatures required to destroy pathogens).

FACT SHEET #9: On-Site Composting - Multi-Residential

Description

For many households, particularly those living in multi-residential housing (apartments, townhouses etc.) participation in backyard composting programs is not possible. On-site composting in these situations requires shared use of and responsibility for the composting site.

Successful on-site multi-residential programs requires the cooperation and participation of:

- building residents
- building owners
- building/property management
- local municipality

Experience with existing programs in Ontario and other jurisdictions suggests the following criteria for evaluating potential multi-residential on-site composting projects:

- leadership - presence of an established resident organization
- building ownership/management - resident involvement in building ownership/management
- existing waste management practices - buildings that pay for private waste collection have incentive to reduce costs
- performance in recycling - indicative of resident/management commitment to 3Rs programs
- gardening & landscaping activity - enables residents to derive direct benefit
- physical space - available space must accommodate composting
- interest level/commitment - residents/owners/managers must be willing

Suitable organics

As for backyard composting.

Unsuitable organics

As for backyard composting.

Current activity

Multi-residential on-site composting is a relatively new concept in wet waste diversion. Metro Toronto has an active community composting program and has helped to establish over 25 multi-residential composting projects.

Several other municipalities have undertaken pilot projects in this area including the Region of Waterloo and the City of Barrie. Thirty-five to 50 per cent of the residents in a housing co-op in Waterloo, Ontario, participated in the co-op's composting program. As a result, the co-op cut its waste disposal fees in half.

Multi-residential systems are often spear-headed by one or a few people who encourage others to participate in the program. This is especially true in housing co-ops where the idea of shared responsibility toward the property is strongest.

Most existing projects are located at housing cooperatives and only a few projects at other housing types (esp. townhouses, apartments) are underway.

Who is currently involved

Most existing programs have begun as a result of municipal initiatives. In these cases municipalities have provided:

- composting units (or construction materials)
- advice on set up and operation
- information and ongoing support

The RCO has developed training programs for multi-residential on-site composting.

Potential for diversion

This option has some potential for increased diversion of wet wastes. The ultimate diversion potential is constrained by:

- the number of households in multi-residential housing
- suitability as described by the above criteria
- suitability of wastes

FACT SHEET #10: On-Site IC&I Composting

Description

For certain industrial, commercial and institutional sector establishments, composting of their organic wastes on-site presents a viable means of reducing waste disposal fees. Also, in some cases the cost of purchasing traditional soil amendments, such as peat moss, as part of their landscaping maintenance costs can be avoided.

Existing on-site programs in Ontario typically process between 20 and 150 tonnes annually. The types of systems in use includes in-vessel, aerated static pile and turned windrow. Some in-vessel systems use vermiculture technology to degrade and stabilize the organic material.

On-site composting has potential application in:

- hotels and restaurants
- resorts,
- schools, colleges, universities, and
- any other establishment where a large number of meals are prepared and/or consumed.

Suitable Organics

In-vessel systems are generally capable of processing all wet wastes and paper fibre products (paper towels, old corrugated cardboard etc.).

Unsuitable Organics

Static pile and windrow systems should avoid meats, oils and dairy products to limit potential for odour and nuisance problems.

Current Activity

Development of on-site composting programs is recent and is a response to high disposal costs and lack of access to centralized composting systems.

Available information on IC&I on-site composting is limited to programs at government institutions such as hospitals and correctional facilities. There are more than a dozen operating programs at government facilities and all are less than 2 years old.

Existing systems compost cafeteria food wastes, yard wastes and livestock manures. Normally these wastes are bulked with wood chips, sawdust or peat moss.

On-site composting has been part of normal operations of greenhouse, nursery and similar operations for years however no information is available.

Who is Involved

Management Board Secretariat, a part of the provincial government, manages provincial government properties and has established all existing government programs.

Several private sector interests are developing in-vessel technologies to meet the requirements of on-site composting.

Potential for Diversion

On-site composting in the IC&I sector has some potential for increased diversion of wet wastes. The ultimate potential of this option is constrained by:

- costs relative to other diversion and disposal options,
- access to other diversion or disposal options,
- development of effective technology.

FACT SHEET #11: Central Windrow Composting

Description

The majority of existing central composting facilities in Ontario are of the windrow type.

Windrow composting involves forming the organic materials into elongated pyramid shaped piles to conserve heat generated by microbial activity. Conservation of heat is required to ensure that thermophilic temperatures (40 - 60°C) are achieved. At thermophilic temperatures degradation processes are rapid and pathogenic organisms are inactivated. An aerobic state is maintained through frequent turning of the windrows.

In addition to collection system requirements, infrastructure requirements include:

- composting site (generally land requirements are greater on a per tonne capacity basis than for in-vessel systems),
- composting pad generally with an artificial base (granular, concrete, asphalt),
- mixing/grinding, turning and screening equipment,
- on-site water management system (drainage, collection, aeration etc.).

In Ontario, the windrow approach has been used successfully to compost leaf and yard materials in quantities up to 50,000 tonnes/year and food wastes from the IC&I and residential sectors in quantities up to 10,000 tonnes/year.

Use of compost is regulated by the MOEE under the "Interim Guidelines for Production and Use of Aerobic Compost in Ontario". Sale of compost is regulated by Agriculture Canada under the Fertilizers Act.

Suitable Organics

The windrow method offers great flexibility and can generally accommodate most wet waste types. Where multiple feedstocks are received, blending is required to create optimum conditions of nutrient availability (C:N ratio), moisture content and structure for composting.

Unsuitable Organics

Because windrow facilities are generally open and have limited ability to contain or abate odours, receipt of wet wastes with high odour potential should be considered only in situations where management is very experienced and where the composting site is well isolated from residential areas, schools etc.

Current Activity

Over 100 existing active municipal leaf and yard waste composting sites in Ontario processing approximately 200,000 tonnes annually. Most municipal sites are less than two years old.

To the present, municipalities have been providing finished leaf and yard compost free to residents to encourage participation in 3Rs programs. Currently, municipalities that produce significant quantities of finished product are exploring bulk sales or brokering through topsoil and landscaping companies.

Presently, more than a dozen active private facilities compost leaf and yard wastes, manures, wood and paper fibre wastes, paper mill sludges and some IC&I food wastes. Finished product is either bagged for sale to the residential market or sold in bulk.

Provincial 3Rs regulations require certain municipalities to collect source separated leaf and yard waste and have access to leaf and yard waste composting sites. These regulations also provide a streamlined approval process for leaf and yard waste composting sites as defined in the regulation.

Potential for Diversion

Further development of windrow composting sites for leaf and yard wastes has the potential to divert a large quantity of additional materials.

The potential to increase diversion of IC&I and residential food wastes through windrow composting facilities is large. The ultimate potential of this method of diversion is constrained by:

- development of site management ability,
- locating sites that are suitable from an environmental and economic perspective (ie. separation distance from residential areas and surface waters, and economic, ie. close to point of wet waste generation, perspectives).

FACT SHEET #12: Central Composting - In-Vessel

Description

In-vessel systems are those in which the high rate, thermophilic stage of composting occurs within a building and/or within fully or partially enclosed vessel. Several generic types of in-vessel technology have been employed in other jurisdictions, primarily Europe including open channel, container and rotating drum systems. Existing and developing facilities in Ontario are of the channel type.

In-vessel systems provide the best possible control of critical process conditions through continuous monitoring, forced aeration and isolation from unfavourable climactic conditions. On the basis of per tonne capacity, in-vessel systems generally require less space than windrow systems but also require greater initial capital investment.

Infrastructure requirements for central in-vessel composting systems include:

- collection system possibly requiring specialized vehicles and containers to facilitate separation and storage at the point of generation,
- composting site which can accommodate material receipt and preprocessing, active composting and curing stages as well as post processing operations such as screening,
- odour abatement system such as biofilters, wet scrubbers or incinerators.

Use of compost is regulated by the MOEE under the "Interim Guidelines for Production and Use of Aerobic Compost in Ontario". Sale of compost is regulated by Agriculture Canada under the Fertilizers Act.

Suitable Organics

In-vessel systems can successfully compost all wet wastes as well as sludges and paper fibre wastes. Where a variety of feedstocks are received, blending is required to achieve optimum conditions of nutrient availability (C:N ratio), moisture content and structure.

Unsuitable Organics

The design of the in-vessel process may limit the flexibility of the facility to receive a feedstock stream that varies widely in composition and consistency.

Current Activity

There are only two operating in-vessel facilities in Ontario. The largest processes approximately 8,000 tonnes annually.

Several municipal in-vessel systems are under development as part of wet/dry or sludge composting programs.

A number of private facilities are in the proposal and design stage.

Future in-vessel composting system development is centred around larger urban centres in southern Ontario.

The current rate of development of centralized facilities is limited by:

- initial capital investment,
- competition with inexpensive options such as disposal, export and animal feeding, and
- public opposition to facility siting.

Potential for Diversion

The potential to divert additional organics through centralized in-vessel systems is very large.

Factors which constrain the ultimate potential of this method of diversion include:

- high capital costs,
- competition with other diversion options,
- market for finished compost product.

FACT SHEET # 13: Anaerobic Digestion. Methanol Production.

Description

Anaerobic digestion is a biological process for the decomposition of organic matter which occurs in the absence of oxygen (as opposed to aerobic composting). This process converts complex carbohydrate molecules into an unstable organic mass (undegraded substrate + biomass) and a gas containing methane, carbon dioxide, hydrogen sulphide, nitrogen and water.

The anaerobic nature of the process requires that it occurs in an enclosed vessel. Temperature, moisture content, nutrient availability and pH are tightly controlled. Most processes require feedstock preprocessing to achieve with 15-25 percent solids and operate at temperatures in the mesophyllic range (35-37° C). Typical resident times within the vessel are 10-20 days depending on temperature and the nature of the feedstock.

The resulting organic mass requires a subsequent period of controlled aerobic decomposition (composting) to stabilize. Once stabilized this material may be suitable for use as an organic soil conditioner provided that contamination is within acceptable limits.

Methane produced by the process could be utilized for heating on site or could be sold. The potential also exists to convert methane (CH_4) into methanol (CH_3OH) through a well established gasification process. Methanol, also known as wood alcohol or methylalcohol can be blended in small amounts with gasoline to produce a cleaner burning automobile fuel.

Suitable Organics

- Municipal sewage treatment plants (STP's) have been treated by anaerobic digestion for many years.
- Can process all organics and fibre materials although resident times would be longer for cellulosic materials.
- Best suited for high moisture wastes (sludges, slurries etc.).

Level of Activity

- Many STP's have anaerobic digesters for sludge treatment.

- Currently no facilities to digest MSW wet wastes in Ontario.
- Many European countries particularly Denmark, France, Austria and Britain have facilities processing up to 72,000 tonnes/year MSW wet wastes and sewage sludge.

Potential for Diversion

Anaerobic digestion has the potential to divert a very large portion of the MSW wet waste stream. Anaerobic digestion is successful in other jurisdictions and it is presumed that similar results could be achieved in Ontario. This approach to MSW diversion is as yet unproven in Ontario.

Factors that could limit the ultimate development of anaerobic digestion include the:

- cost relative to other management options,
- need for sufficient quantities of clean feedstocks.

Chapter 3

Issues in Wet Waste Diversion

3.1 Introduction

Each of the STEWWR subgroups was asked to review those aspects of waste reduction and diversion that fell within their individual terms of reference. The goal of this exercise was to catalogue the issues and concerns that may have an effect on the increased diversion of wet wastes from landfill.

A number of issues, particularly in the areas of provincial regulation and public education, were raised by more than one subgroup. Each of these issues has been drawn from subgroup documents, consolidated by the Writing Team according to subject and regrouped under the following seven headings:

The order in which the various issues appear does imply their priority. For example, a number of complex issues could be placed into any of several categories. The lack of central composting or other types of infrastructure in many communities could be explained in terms of regulatory (i.e., deficiencies in the approvals process), economic (the cost of siting, building and operating the collection and management systems) or even market conditions (the need to develop viable, local markets for the compost produced). Chapter 3 explains why adequate wet waste diversion infrastructure is not yet in place.

The issues described in this chapter reflect a wealth of opinion on the current successes and future opportunities for wet waste diversion efforts in Ontario. Based on their individual experience, stakeholders may perceive certain issues and their resolution in different ways. During their deliberations, the STEWWR subgroups have found common ground in most areas but, in several instances, a divergency of views has not been completely resolved. As a result, there may not be unanimous agreement on the content of each issue statement presented in the

following sections.

3.2 Legislative & Regulatory Issues

The approvals process for proposed diversion projects is not always timely, consistent or predictable.

(i) There are inconsistencies between the MOEE's regional offices in their interpretation and application of guidelines and regulations relating to direct land application, central composting and other diversion options. The conditions placed on Certificates of Approvals (C of As) are not always consistent.

(ii) Approvals may not always be issued in a timely fashion. Delays often close the "window of opportunity" that exists to use certain organic wastes on farm lands during those limited times in the pre- or post-growing season when they may be applied. The failure to process applications for other types of diversion options in an expeditious manner may also jeopardize their implementation.

(iii) There is no application guideline for Environmental Protection Act approvals available to steer proponents (and MOEE officials) through the approvals process for land application or central composting projects. In addition to inconsistencies and delays, it is possible that the lack of guideline information results in overly onerous approval requirements.

(iv) Uncertainties and delays in the approvals process make it difficult for proponents to plan diversion efforts, anticipate approval conditions or accurately estimate costs.

(v) For well-researched and understood waste management activities, an abbreviated permit-by-rule approach could prove timely, cost-effective and expeditious.

(vi) Existing Certificates of Approval for recycling centres (MRFs) do not permit the bulking or staging of wet wastes. Staging would allow the consolidation of small loads, reduce shipping costs and control contamination of wet waste feedstocks. Amending individual certificates to permit staging is a time-consuming and expensive process.

In some instances, provincial guidelines are incomplete or out-of-date.

(i) Measuring and monitoring odours and ground/surface waters is not well defined

in provincial environmental protection regulations making compliance problematic. The MOEE lacks the resources to investigate every odour complaint expeditiously. The problem may dissipate by the time an inspector arrives.

(ii) The guidelines for the land application of wastes other than municipal sewage sludge should be expanded.

(iii) The compost guideline should be reviewed and/or expanded to address the issues of sampling and analytical methods and compost quality criteria, including maturity standards.

(iv) There are a wide range of concerns centering around the tests and standards designed to ensure the compost derived from wet wastes is an environmentally sound product. For example, the cost of source waste testing may be prohibitive and the results inconclusive. Some compost quality criteria (that for mercury, for instance) are considered too stringent and may unnecessarily limit the end use of some material. And the presently-used methods for determining true quality of finished compost are uncertain.

There may be an opportunity to enhance regulatory incentives and dismantle disincentives.

(i) Ontario's landfills continue to accept most wet wastes and other organics for disposal. Some stakeholders believe selective restrictions on the collection and/or disposal of wet wastes would encourage the development of diversion options. On the other hand, industry stakeholders believe that access to local composting or other suitable diversion facilities must be guaranteed before such restrictions could be considered. They insist that banning disposal, without first ensuring adequate, affordable diversion alternatives are in place, is not appropriate.

(ii) Local bylaws may prohibit the direct land application of wet wastes, mid-scale, on-site composting (MOC) or other diversion options. In addition, building codes may restrict 3Rs collection and diversion amenities, particularly for high rise and multi-unit buildings.

(iii) The Ontario 3Rs regulations do not require designated IC&I generators to specifically address organics or wet wastes as part of their source separation and recycling activities.

(iv) Although the Ontario 3Rs regulations address municipal backyard composting programs, no targets or goals for participation levels are set.

The issue of disparate standards of environmental protection and the need for a "level playing field" has not been adequately addressed or resolved.

(i) To ensure a fair, competitive marketplace, all receivers of organic wastes (both private and public sector) should be required to maintain an equivalent level of environmental protection. Unregulated receivers or those assigned only minimal compliance requirements may be in a position to undercut the prices of their more heavily regulated competitors. In addition, some of the major end-users of IC&I organic wastes are situated in the United States and may be operating under less restrictive regulatory conditions.

The public is not always involved from the earliest stage in the approvals process.

(i) The public is more sensitive to environmental issues today than ever before. If the public is involved early in an open approvals process and has access to the relevant environmental and health impact information, many of their concerns may be satisfied and their opposition may be abated. (Under the Environmental Bill of Rights, many classes of proposals that require MOEE approval must be listed on the publicly-accessible environmental registry.) While such an approach will not eliminate NIMBY opposition, it is preferable to the alternative; delaying public involvement will often solidify opposition and block the timely implementation of proposed direct land application and central composting projects.

The lack of "Good Faith Donation Legislation" or similar regulatory protection may discourage the use of primary use options by some potential donors.

(i) Existing legislation is adequate to ensure the safety of food products that are sold. Potential donors to food banks stress the need to maintain the quality, and hence the safety, of the product through the primary use redistribution system. Some suggest that this can be achieved by expanding the coverage of existing legislation to include food products that are donated.

(ii) The potential liability of donors may act as a deterrent to the diversion of edible food from disposal through primary use programs. Grocery manufactures and distributors stress the need for the introduction of "Good Faith Donation Legislation" which would encourage potential donors to contribute (and current donors to continue their involvement). At this time, legislation that would limit food donor liability does not exist in Ontario.

(iii) Some stakeholders do not support the introduction of such legislation.

3.3 Occupational Health & Safety Issues

The occupational health and safety risks specific to central composting and other diversion processes have not been addressed directly.

(i) Health and safety concerns have been raised in the operation of wet waste diversion facilities. For example, there are no provincial workplace exposure standards or occupational safety guidelines specific to composting facilities. While there is little reference to health and safety problems of compost facility workers found in the occupational safety literature, high levels of dust, air-borne organisms and bio-aerosols, methane and any other contaminants may pose a risk.

(ii) The use of grinders, front-end loaders, tractors, spreaders and other heavy machinery may increase worker safety risks, and should be addressed as well.

(iii) Municipalities and other proponents that are required to draft contingency and emergency response plans (covering fire, evacuation, environmental releases, etc.) would find provincial guidelines, model plans or other emergency planning guidance useful.

3.4 Public Perception Issues

NIMBY-styled opposition, in some cases based on fears of pollution or the suspicion that property values will drop, may delay or derail proposed diversion projects.

(i) The public harbors a number of perceptions/misconceptions about the environmental risks of composting (both centralized and MOC), direct land application and other diversion efforts. Concerns about the release of air-borne organisms, the proliferation of rats, flies and other pests, and other health-related impacts are largely unfounded. As well, odour problems do not represent a public health risk. In recent investigations of odour complaints, no empirical evidence of health problems have been found. Misconceptions can be spread by stories carried in the media.

(ii) Aesthetic concerns, such as transient and temporary odour problems, may give rise to perceptions of health risks among the neighbouring community. While farming families may have grown accustomed to (and accept the necessity of) the smell of manure and other occasionally foul odours, urban dwellers can be far less tolerant of such aesthetic infringements. In addition, few members of the public, to say nothing of the decision-makers that must field their complaints, are familiar with the workings of composting windrows, manure/wet waste spreading and

other waste diversion activities.

The public does not always understand the environmental benefits of waste diversion. Lines of communication with the public must be kept open and an informed dialogue on issues of concern encouraged.

(i) Poorly designed and/or operated composting, land application or diversion facilities, that have been responsible for negative environmental impacts, have also soured the acceptability of new ventures for a certain segment of the public. In some instances, the causes of the problem (and actions taken to correct it) have been poorly communicated. Some segments of the waste management and recycling industry have not established open lines of dialogue with their immediate neighbours or the surrounding community.

(ii) Community liaison committees, open houses, newsletters, signs on facility property and collection trucks, and other communication tools, which spell out how a direct land application or composting facility works, who is responsible and how interested residents can obtain more information, may help relieve public anxiety.

(iii) Intensive, well-designed and continuing public education campaigns result in high levels of participation in backyard composting. Also, MOC and central composting projects are widely accepted.

(iv) Awareness of the environmental benefits of primary use programs should be increased. Primary use options should be addressed, within the context of other waste diversion methods, as part of any comprehensive wet waste diversion communication or education effort.

3.5 Information, Training & Operational Issues

There is a lack of "how to" training and good written information on some aspects of waste diversion available for use by generators, regulators and managers/operators of diversion programs.

(i) There is a wide disparity in the level of understanding of wet waste diversion opportunities among the various stakeholders, including provincial (MOEE and OMAFRA) and municipal officials, generators, private sector proponents, haulers, farmers, etc. Untrained or poorly trained staff, particularly in the approval or regulatory branches, may impose impractical or unreasonable conditions on proponents. On the other hand, farmers may not recognize the benefits of wet

wastes applied to their lands (either directly or as finished compost), and generators may not be familiar with the diversion potential offered by 3Rs options.

(ii) While some aspects of waste diversion are well documented, there is a need to compile and disseminate how-to information, including operations manuals, standards for good management practices, and case studies, that highlight successful reduction, reuse and recycling programs. Training is needed in the areas of direct land application, wet waste collection and handling, and composting (centralized, MOC and backyard). For example, operational manuals for leaf and yard waste composting sites complemented by hands on training will help ensure that these sites are operated successfully (ie. minimize off-site impacts, produce good quality compost and be cost effective).

(iii) All generators need good information and training to assist in the proper on-site separation, handling, contamination reduction and storage of wastes to ensure their suitability for reuse and/or recycling. Current education efforts should be both continued and expanded.

(iv) Currently the only composting training available is of the "on-the-job" variety which usually involves a trial and error approach to learning. While practical experience is invaluable, adequate training and "certification" could prevent system failures, with their attendant social and environmental repercussions. Both short and long-term curriculum development needs must be addressed.

(v) Community composting is a rapidly-developing diversion area. Resources need to be devoted to background information, basic training, trouble-shooting, community relations, NGO and community promotional programs, etc..

Training is not usually backed by adequate on-site technical support and trouble-shooting services.

(i) Technical support and other hands-on guidance is needed to troubleshoot compost processing system problems, prevent failures and optimize process efficiency.

In some cases, information and training resources are not up-to-date, comprehensive, affordable and/or widely promoted.

(i) There is no central source of scientific and technical information on wet waste diversion processes, technologies and operational experience. While a wealth of such information exists, it is difficult to access, particularly in areas distant from

major urban centres.

(ii) The cost of obtaining technical information may be prohibitive, especially for individuals, citizens' groups and small and medium-sized businesses.

(iii) There is an opportunity to export Ontario's expertise in composting. For example, "The Master Composter" and the "Training the Trainer" courses developed by the Recycling Council of Ontario offer an excellent foundation for success, and could be advertised, through University cooperative extensions or waste management magazines, across Canada and the U.S.

Effective education programs promote, motivate and inform. Not all stakeholders in the public and private sectors view or treat wet wastes as a valuable resource.

(i) Good motivational information, directed at the residential and IC&I wet waste generators is needed on: methods to reduce/reuse food wastes; methods to reduce leaf and yard wastes; the cost-benefits of home composting and mid-scale, on-site composting (MOC); the promotion of backyard composting; and the land application of wet wastes. Provincial and municipal decision-makers should be reminded of the value of composting and other wet waste diversion options.

(ii) The promotion of backyard composting has to overcome special barriers: motivating that 60 per cent of the population that (while predisposed to recycling) requires additional encouragement, attention and/or incentive; ensuring home composters don't backslide and abandon their efforts; involving transient renters, especially those in apartments and other multi-unit residences; and devising distribution, educational and troubleshooting services to overcome participant hesitancy.

In some cases, information and training resources are not tailored to meet the specific needs and answer the questions of generators and/or users.

(i) Generators, planners and waste management officials have a number of unanswered questions that may hamper the implementation of wet waste diversion projects, including direct land application, composting and other innovative solutions. These include:

- What kinds of wet wastes are available?
- Are they of consistently good quality and do they contain unacceptable contaminants?
- How can they be separated and collected in a cost-effective manner without

impacting their utility?

- What are the beneficial effects of their use?
- Who is interested in using them?
- Are there any detrimental effects on the environment, public health or worker safety?
- What are the full costs involved (including transportation, handling, capital, operating and administrative)?
- Which of these costs will be borne by the generator and society?
- What are the savings of wet waste diversion? And who will benefit?

(ii) The waste management industry must be aware of the concerns and requirements of the agricultural community. Animal feed derived from food wastes must meet the nutrient requirements of the user (without negatively impacting on growth rate, feed efficiency or reproductive performance). It must be consistent throughout the year in terms of both supply and quality and must be compatible with the feed handling equipment used on the farm (most of which is designed to handle products meeting certain physical specifications, usually dry, pelleted or finely-ground feed types). The economics of using waste-derived animal feed must be competitive with feed from conventional sources.

3.6 Affordability, Financing & Funding Issues

The low tipping fees charged in many communities may act as a disincentive to diversion.

(i) The financial viability of wet waste diversion plans can be undercut by the low tipping fees that some communities charge for landfilling (or other disposal services). Tipping fees of $30 a tonne (or less) serve as a disincentive to many 3Rs programs and make disposal the most attractively priced option for IC&I generators. Tipping fees also vary widely across the province and are subject to change without notice (or public debate).

(ii) Many stakeholders note that IC&I generators in many communities face high tipping fees and hauling charges. They urge that increases in disposal charges should be paced with increased access to composting and other local diversion opportunities.

(iii) It is also possible to export wet wastes and other MSW recyclables compostables to U.S. landfills at costs well below that of many environmentally responsible diversion options. Some stakeholders urge the province to restrict the

export of wet wastes.

(iv) Residential generators currently receive no direct financial benefit (in terms of avoided disposal costs) for their waste reduction efforts. (Amendments to the Municipal Act have made it possible for communities to charge user-pay fees.)

Because wet wastes are generated by virtually all sectors of society (both residential and IC&I), financing models different from those used to fund other kinds of waste management systems may be needed to support the establishment of the wet waste diversion infrastructure.

(i) Affordability is the most important issue raised by a number of generators when addressing wet waste diversion options and the provision of infrastructure. There is a lack of solid information on capital costs, operating costs, end-product revenue potential, long-term savings on tipping fees, pay-back periods, government support, etc..

(ii) In many cases, insufficient economic incentives or support programs exist to favour the implementation of wet waste diversion options, particularly those with higher, front-end capital costs.

(iii) A provincial funding program is required to support on-site composting by the non-profit sector.

(iv) Demonstration and pilot projects contain an element of risk. Companies, municipalities, industry groups or individuals may be reluctant to undertake such efforts unless the proper incentives are provided. While certain funding mechanisms have been implemented, the capital costs of larger projects may exceed the funds available through existing provincial funding programs. In addition, the available funding is insufficient to meet the total expected demand.

(v) On the other hand, the fact that funding is available may deter some proponents from pursuing other innovative financing solutions (such as public/private sector co-ventures), building reserve funds for diversion activities, or scaling projects up from eligible pilot or demonstration scale.

(vi) There may be a need to develop new models for infrastructure development that combine private and public sector involvement and expertise. Each side can bring their strengths such as financial resources, established infrastructure, technical expertise, land holdings, organizational and management abilities, and political acumen to consortium efforts. A consortium may be later able to steer

diversion projects through the difficult design, approval, construction and start-up stages.

Funding and other support programs are not always widely promoted.

(i) Many generators and other stakeholders are not aware of the funding support and other incentive programs offered at the federal, provincial and municipal level.

3.7 End-Product Quality & Marketing Issues

The success of many diversion efforts depends on stable and sustainable markets for the compost or other end-products produced.

(i) Do sustainable markets exist for the end-products of the diversion process? For example, there is uncertainty regarding the capacity of the marketplace to absorb the potential supplies of compost that may be produced, as well as concerns that increased supply may depress prices below sustainable levels. In a similar vein, are there a sufficient number of farmers, located close to food waste generators, in a position to utilize additional recovered foodstocks as feed?

(ii) While some participants believe the demand for compost should be market-driven (i.e., users should pay a reasonable price for the compost produced), other stakeholders insist that compost has an intrinsic value to both the environment and society that supersedes free market considerations. They believe that if markets will not support compost production costs, some mechanism to subsidize these costs should be developed to ensure the valuable organic components of wet waste are returned to the land.

(iii) There is a need to inventory all existing compost markets, identify new markets, and investigate the feasibility of replacing other products currently on the market with wet-waste diversion end-products (for example, using compost instead of peat moss). While agricultural users may provide long-term markets, these will have to be developed. In the interim, nurseries, greenhouses and home gardeners may provide strong markets.

(iv) Whether one is interested in producing quality animal feed, compost or biofuels, dependable supplies are needed to make production and marketing economically viable. Those sources generating high-quality waste feedstocks need to be identified.

(v) Municipal composting facilities, which distribute compost free-of-charge, may undermine private sector compost producers.

(vi) Because of its low weight and high bulk, economically viable markets for compost are limited, in part, by transportation costs. Transportation concerns may also limit the markets for waste derived animal feed and for redistribution to primary use agencies (as special handling or refrigeration may be required).

(vii) Procurement policies specifying wet-waste derived products (such as compost, biofuels, etc.) would promote market stability.

End-product marketability depends on consumer confidence. To ensure demand, the quality of end-products must meet the requirements of consumers.

(i) There is currently no MOEE approved method for determining the maturity of compost. Compost producers must either submit a proposed method to the MOEE for approval or cure the material for a minimum of 6 months. Adopting a standard maturity measurement will help ensure consistent product quality and may enable some producers to reduce material storage costs.

(ii) Many potential feedstocks for composting operations are heterogeneous and variable by nature. As well, many composting operations receive materials from several different sources. To help ensure consistent end product quality, standard sampling methods for both feedstock and finished product streams must be determined. As well, standard analytical methods for parameters of environmental concern as specified by the compost guideline, and those of concern to end users, such as salinity, organic matter content, water holding capacity etc. are required.

(iii) Collectors, haulers, and transfer stations that handle wet wastes must be cognizant of the quality concerns of end-users. Good management practices are paramount to maintaining feedstock quality, minimizing contamination, and ensuring the marketability of end-products.

Some food wastes are used as animal feed. There is a need to ensure only quality food waste supplies are fed into this stream.

The practice of feeding good waste to livestock is years old. The recent scrutiny by the media has resulted in some controversy regarding the practice, indicating a need to sort out the fearmongering and misinformation, from what is indeed fact.

Beef, swine and poultry producers are very concerned that the misinformation

regarding the use of food wastes as animal feed might damage the quality image of their product. If the public's perception of waste-fed livestock is negative, consumers (as well as packers/processors) would be less willing to purchase animal products made from animals raised on such feed.

This indicates a need for both quality control of food wastes passing into animal feed and education of the public regarding this practice.

Food waste diverted to animal feed can come from pre-consumer and post-consumer sources. Pre-consumer food waste, which is unlikely to contain artificial additives, includes food grown and left in the farmers field, and meat and vegetable trimmings discarded from the product before being sold. Post-consumer food waste from restaurants or commercial sources may contain additives.

Research is needed to determine the impact of and the potential for bioaccumulation (if any), of additives such as artificial flavours and colours in animal feed. Naturally occurring flavours in such food wastes as onions, garlic and fish can impart disagreeable flavours and naturally occurring pigments as in tomato pulp, can yellow the fat of beef cattle. Farmers should have access to the contents of the food mixture, in order to determine the suitability for feed to a particular type of livestock.

Research is also needed into the potential for diseases, such as salmonellosis. It is transmitted through improperly prepared animal feed, particularly that produced from post-consumer sources.

Proper controls at source and in the preparation of feed made from food waste is essential to ensure contaminants such as glass fragments and paper wrappings are removed so as not to injure the animal.

3.8 Technology, Research & Development Issues

Research priorities for diversion options must be identified and assessed on an on-going basis. A number of research needs have been identified.

(i) The long and short-term benefits of wet waste diversion (and the utilization of compost and other diversion end-products) have not been clearly quantified or are not widely understood. Research should address the costs and benefits of intensive BYC, MOC, central composting, wet/dry systems, etc. In addition to avoiding disposal-related costs, the proper cost-benefit assessment of wet waste diversion requires information on: savings in top soil replacement; reduced demand

for animal feed, fertilizers, soil amendments, pesticides and other landscaping, agricultural and gardening costs; improved community relations; etc.

(ii) Where uncertainty exists as to any environmental or health effect, the potential risk should be investigated, clarified and quantified. For example, the current methods of odour analysis or the spread of Aspergillus could require further research. All study results should be vetted according to established scientific standards and disseminated to the public.

(iii) There is some uncertainty over the extent and suitability of untapped food resources that could be diverted to food banks and other primary users.

(iv) More information on the qualities, characteristics and suitability of wet wastes for direct application to agricultural and other land uses (reclamation, forestry) is needed. While reasonably good information exists on the availability of sewage sludges, there is no reliable data on the quantity and quality of other appropriate organic wastes that may be available. In addition, there is little information on the environmental impacts of the land application of food processing wastes and other candidate materials.

(v) The beneficial effects of compost use in agriculture (on a crop-specific basis) and other uses such as land reclamation and forestry must be documented. Only limited data exists on the economic and environmental impacts of compost use (in terms of long-term improvements in soil fertility, higher crop yields, displacement of requirements for conventional fertilizers, increased resistance to drought, erosion and pests, etc.).

(vi) There is a need to research the most effective methods of BYC, MOC and other on-site diversion program funding, promotion, public education and composter distribution.

A number of technology development needs have been identified.

(i) Waste reduction and reuse-related R&D would increase the wet waste diversion opportunities in the food processing sector. Such efforts could address, among other issues: the development of pest-resistant foodstuffs suitable for long-term storage; methods of harvesting optimization; the opportunity for food by-product production opportunities; high-efficiency, low-waste food processing technologies; improved storage conditions and feedstock handling techniques; and new consumer products that could minimize food waste (such as smaller servings/packaging sizes, etc.).

(ii) Additional research is needed to refine low maintenance lawn and low waste landscaping practices, including suitable plant varieties, to the Ontario climate.

(iii) Composting and other diversion technology is a rapidly developing field. New systems coming into use raise a number of management questions concerning: capital and operating costs; special labour requirements and training; the capacity of the system to handle the feedstocks generated; the environmental control features (to prevent odours, pest control or leachate problems); environmental approval status; the need to preprocess feedstocks and/or add bulking agents or other amendments; the need for other handling equipment (front end loaders, grinders, mulchers, etc.); the life-expectancy of the system; the quality of the finished product; and employee health and safety concerns.

(iv) There is a need to determine the most efficient and cost-effective urban collection system (for example two-stream versus three-stream source separation), and develop a practicable rural collection infrastructure.

(v) High-rises and buildings, especially those lacking green space, pose special collection and on-site composting problems. Retrofitting existing buildings with multi-stream collection chutes may be prohibitively expensive. The development of a sanitary, effective and convenient collection system is needed. The design of new high-rises must incorporate flexible, innovative systems to collect wet wastes and other recyclables. The impact of building codes should be addressed.

(vi) There is a need to develop MOC technology through pilot projects. There is also a need to develop operational models for MOC systems (that cover management responsibilities, technology, use of compost, etc.).

(vii) Other technological gaps that need to be resolved through future R&D may involve determining: the necessary degree of pre-processing feedstock to ensure process efficiency; the final screening required to produce marketable compost; proper feedstock storage and handling procedures for generators and transporters (that address leachate, odour and sanitation concerns); and the effectiveness and design of odour control equipment and approaches (especially for open facilities).

A number of technology support and infrastructure needs have been identified.

(i) Sufficient storage capacity may not exist in certain areas to allow wet wastes to be stored during times when land application is not possible (i.e. during the winter when soils are frozen, during wet periods, during hot or humid weather, or when crops are growing). In other cases, the necessary equipment for transporting,

preparing or spreading wastes is not available. Support programs, on a case-by-case basis, may be necessary to alleviate such problems.

(ii) In a similar vein, infrastructure needs, including collection, transportation, sorting and storage, must be assessed for other diversion options.

(iii) The resources necessary for the collection, handling and distribution of food products to food banks and other primary use outlets are, to a large degree, provided on a voluntary or donation basis. Although this issue was identified by the STEWWR subgroup, the degree to which the lack of these services limits quantities of food redistributed was not discussed. Also, recommendations on possible remedies were not made.

Chapter 4

Development of the Action Plans

Each task group cooperatively developed a set of recommendations for components of a strategy for diverting organic waste from disposal. The recommendations were developed through a process that began by identifying barriers and roadblocks to waste diversion and concluded by highlighting 3Rs opportunities for waste minimization.

These recommendations are the basis for the Action Plans. Where appropriate, similar recommendations developed by different task groups were amalgamated into one or two Action Plans. A complete listing of Action Plan titles organized by issue area is presented in Table 3.

The Action Plans describe a variety of 3Rs initiatives that could be undertaken in the short and long terms. As well, it is recognized that a significant amount of work is currently underway within some stakeholder organizations. No attempt was made to list work in progress as any published listing of such activities would undoubtedly be incomplete and would quickly become obsolete.

The intent of the Action Plans is not to "reinvent the wheel" but to be an extension of existing efforts already underway and complement provincial efforts to divert solid wastes from disposal. It is expected that those agencies with lead roles in implementing the various Action Plans will take full advantage of existing information and work in progress.

Each Action Plan includes a series of standard components which describe the purpose(s) and context of the Plan as well as the specific steps that must be taken to achieve the objective. The common format developed for presenting the Action Plans includes:

- a descriptive title and identification number,
- a statement of purpose,
- an estimate of the expected duration of the plan from its inauguration,
- a chronology of key steps required to achieve the stated objectives,
- a recommended lead agency to undertake the key step(s),
- any organizational or program linkages.

The expected duration of the Action Plans range from six months to up to two years. Appropriately, some Action Plans are of an ongoing nature and in other

cases it was impossible to realistically determine the duration due to the influence of factors beyond stakeholder control.

Lead agencies assume the responsibility of obtaining resources necessary to complete the required tasks. Support agencies are called upon to assist in the delivery of the Action Plans where possible. They can for example, provide information and resources where appropriate.

Action Plans may need to be phased over a realistic period of time. For this reason criteria have been developed to rationalize the implementation of the Action Plans. The Action Plans are organized on the basis of the following criteria:

- **"Underway"** - Plans that are currently underway and will be completed in the short term.

- **"Priority"** - Plans that (in the opinion of the Writing Team) are needed to facilitate the resolution of an issue of primary importance. Some primary Action Plans are logical precursors for secondary plans.

- **"Secondary"** - Plans that have as a prerequisite the completion of another Action Plan(s).

Table 3 lists the Action Plans by diversion option.

Action Plans have also been categorized by subject area under the following seven headings:

- Regulations, Policy and Guidelines,
- Training and Operations,
- Education and Promotion,
- Market Development,
- Technology Development/ R&D,
- Funding and Economic Incentives,
- Data and Information Systems.

Regulations, Policy and Guidelines

Action Plans in this area address the need for change and development in areas that are regulated by government agencies and where the IC&I and municipal sectors have a role in establishing voluntary guidelines.

Training and Operations

Action Plans in this area focus on land application and composting options. Although these techniques have been employed in Ontario for some time, there are currently few individuals with the technical background and experience needed to ensure the successful expansion of these activities. Since land application and composting have a significant element of public exposure, ensuring that practitioners receive the training necessary to avoid negative environmental impacts and public opposition is critical.

Education and Promotion

Expansion of diversion options can be hampered by lack of awareness of the need to conserve organics as a resource and the tradeoffs between diversion and disposal options. As well, widespread misconceptions regarding the impacts of land application programs and composting facilities are delaying new programs and facilities. Action Plans in this area try to refocus existing information on key target audiences and as a result increase their familiarity with and acceptance of diversion systems.

Market Development

Developing Ontario's composting infrastructure will depend in part on strengthening the markets for compost products. Action Plans in this area try to expand the market for compost products through coordinated marketing strategies. The strategies identify end user requirements and provide a forum for direct producer - end market user networking.

Technology Development/ R&D

Of the diversion options for organic waste, composting (particularly on-site and in-vessel) and biofuel systems have the greatest reliance on technology. Various system components, such as collecting, preprocessing, processing, handling and storage, require development or adaptation to the Ontario environment. Private sector proponents of technological systems have the lead role in their development. Action Plans in this area contribute to the knowledge base by undertaking research and development related to the application of technological system.

Funding and Economic Incentives

A major barrier to the development of diversion infrastructure, especially

composting systems is the lack of an economic incentive. Action Plans in this area try to develop alternative models for infrastructure financing.

Data and Information Systems

The focus of the Action Plans in this area is to respond to the information needs of the agencies responsible for the implementation of diversion systems. In many cases, the required information exists but is either in an unsuitable format or is difficult to access.

The objective of these Action Plans is to improve the quality of available information, as defined by its end use, and to provide an improved system through which the information can be accessed.

TABLE 2: SUMMARY OF ACTION PLANS

A/P NO.	ACTION PLAN	DIVERSION OPTIONS: Underway Priority Secondary	LEAD AGENCY	EXPECTED DURATION FROM START UP (MONTHS)
	Regulations, Policy and Guidelines			
1.	Streamline Approvals for Land Application of Candidate Materials.	Priority	MOEE - WRB	9
2.	Develop a Guideline for Obtaining Central Composting Facility Approval.	Secondary	MOEE - WRB/CCC	18
3.	Revise Interim Compost Guideline.	Priority	MOEE - WRB	20
4.	Develop Health and Safety Guidelines for Compost Facility Operators.	Underway	Min. of Labour/MOEE - WRB	9
5.	Compile Background Information on the Status of Municipal Bylaws for the Disposal of Organic Wastes and Develop a Process to Involve All Potentially Affected Stakeholders.	Secondary	AMRC	9
	Training and Operations			
6.	Develop a Leaf and Yard Waste Composting Site Operators Manual.	Priority	AMRC	6
7.	Implement Operations Training for Leaf and Yard Waste Composting Sites.	Secondary	AMRC/MOEE - WRB	6
8.	Develop Operational Guides and Training Program for Mid-Scale On-Site Composting.	Secondary	RCO/CCC	18
9.	Develop Training Program for Home Composting Program Coordinators to Optimize Householder Participation.	Priority	RCO	12
10.	Deliver Training Program on Land Application.	Underway	MOEE - WRB/OMAFRA	6

A/P NO.	ACTION PLAN	DIVERSION OPTIONS: Underway Priority Secondary	LEAD AGENCY	EXPECTED DURATION FROM START UP (MONTHS)
11.	Develop a Land Application Training Program for Farmers.	Underway	OMAFRA	6
	Education and Promotion			
12.	Develop and Host Industry Sector Forums on Wet Waste 3Rs.	Priority	Food Industry Sector	
13.	Develop and Implement a Promotional Plan for Home Composting.	Secondary	RCO	6
14.	Develop Communication Packages on Central Composting.	Priority	CCC/AMRC	18
15.	Document Results of Model Home Composting Demonstration Projects.	Underway	RCO/MOEE - WRB	6
16.	Develop a Helpful Reference Guide on Organics Diversion Initiatives.	Secondary	MOEE - WRB	9
17.	Implement a Communications Plan to Increase Awareness of On-Site Composting.	Secondary	RCO	9
18.	Implement Industry Sector Communication for Organic Waste Diversion.	Secondary	Individually undertaken by key sectors: Food Processors, Grocery Products Manufacturers, Food Service Industry, Grocery Products Distributors/Retailers	Ongoing
19.	Develop Guides for Organic Waste Reduction for Landscape Companies, Municipalities, Other Horticultural Professionals, and the Public.	Priority	Landscape Ontario/AMRC	9
20.	Consult with Stakeholders on the Utilization of Wet Organic Wastes as Livestock Feed.	Priority	OMAFRA	11
	Market Development			
21.	Develop Marketing Strategy for Compost.	Priority	CCC/AMRC	12

A/P NO.	ACTION PLAN	DIVERSION OPTIONS: Underway Priority Secondary	LEAD AGENCY	EXPECTED DURATION FROM START UP (MONTHS)
22.	Develop an Information Package on the Use of Compost in Agriculture.	Underway	OMAFRA	6
	Technology Development / R&D			
23.	Prepare a Comparative Summary of Residential Organic Collection Initiatives.	Priority	AMRC/MOEE - WRB	12
24.	Develop a "Good Practices Handbook" on IC&I Organic Waste Management.	Secondary	MOEE - WRB	18
25.	Develop Information on Odour Abatement Methods For Central Composting Facilities.	Priority	CCC/MOEE - WRB & PACS	12
26.	Implement Broader Range of Mid-Scale On-Site Composting Pilot Projects.	Priority	MOEE - WRB	18
	Funding and Economics			
27.	Develop Recommendations for Alternative Mechanisms to Support Future Expansion of Home Composting.	Secondary	AMRC	6
28.	Develop Information on the Economics of Centralized Composting and on Viable Models for Public-Private Financing, Ownership and Operation.	Secondary	CCC/AMRC	9
	Data and Information System			
29.	Establish Information Collection/Dissemination Network.	Underway	CCC	12
30.	Establish Info Users Group.	Priority	CCC	Ongoing
31.	Establish Tracking Information on Provincial Management of IC&I Organic Wastes.	Priority	MOEE - WRB	12
32.	Establish an Issue Management Team for Central Composting.	Secondary	CCC	Ongoing

NOTE: Please refer to "Appendix A" for the list of acronyms.

TABLE 3: ACTION PLANS BY DIVERSION OPTIONS

NOTE: ( ) - Refers to Action Plan #

UNDERWAY	PRIORITY	SECONDARY
First 2Rs		
	Develop and Host Industry Sector Forums on Wet Waste 3Rs. (12)	
	Develop Guides for Organic Waste Reduction for Landscape Companies, Municipalities, Other Horticultural Professionals, and the Public. (19)	
Animal Feed		
	Consult with Stakeholders on the Utilization of Wet Organic Wastes as Livestock Feed. (20)	
Land Application		
Deliver Training Program on Land Application. (10)	Streamline Approvals for Land Application of Candidate Materials. (1)	
Develop a Land Application Training Program for Farmers. (11)		
Composting - BYC		
Document Results of Model Home Composting Demonstration Projects. (15)	Develop Training Program for Home Composting Program Coordinators to Optimize Householder Participation. (9)	Develop and Implement a Promotional Plan for Home Composting. (13)

UNDERWAY	PRIORITY	SECONDARY
		Develop Recommendations for Alternative Mechanisms to Support Future Expansion of Home Composting. (27)
Mid-Scale On-Site Composting		
	Implement Broader Range of Mid-Scale On-Site Composting Pilot Projects. (26)	Develop Operational Guides and Training Program for Mid-Scale On-Site Composting. (8)
		Implement a Communications Plan to Increase Awareness of On-Site Composting. (17)
Central Composting		
Develop Health and Safety Guidelines for Compost Facility Operators. (4)	Revise Interim Compost Guideline. (3)	Develop a Guideline for Obtaining Central Composting Facility Approval. (2)
Develop an Information Package on the Use of Compost in Agriculture. (22)	Develop a Leaf and Yard Waste Composting Site Operators Manual. (6)	Implement Operations Training for Leaf and Yard Waste Composting Sites. (7)
	Develop Communication Packages on Central Composting. (14)	Develop a "Good Practices Handbook" on IC&I Organic Waste Management. (24)
	Develop Marketing Strategy for Compost. (21)	Develop Information on the Economics of Centralized Composting and on Viable Models for Public-Private Financing, Ownership and Operation. (28)
	Prepare a Comparative Summary of Residential Organic Collection Initiatives. (23)	
	Develop Information on Odour Abatement Methods for Central Composting Facilities. (25)	

UNDERWAY	PRIORITY	SECONDARY
Data and Information System		
Establish Information Collection/Dissemination Network. (29)	Establish Info Users Group. (30)	Compile Background Information on the Status of Municipal Bylaws for the Disposal of Organic Wastes and Develop a Process to Involve All Potentially Affected Stakeholders. (5)
	Establish Tracking Information on Provincial Management of IC&I Organic Wastes. (31)	Develop a Helpful Reference Guide on Organics Diversion Initiatives. (16)
		Implement Industry Sector Communication for Organic Waste Diversion. (18)
		Establish an Issue Management Team for Central Composting. (32)

REGULATIONS, POLICY AND GUIDELINES

ACTION PLAN NO.1 **STREAMLINE APPROVALS FOR LAND APPLICATION OF CANDIDATE MATERIALS**

PURPOSE:

The purpose of this action plan is to improve the administration process of EPA approvals for land application programs such that the:

i) primary objective of environmental protection is maintained,

ii) opportunities to divert candidate wastes are not missed solely as a result of lack of information regarding the application - approval process and delays in application processing, and

iii) regulatory barriers that prevent the use of acceptable alternatives to organic mulch products are reduced or eliminated.

Candidate materials are those that could be considered for land application that otherwise are destined for disposal and include leaves, clean wood waste, sewage sludges, paper sludges and others.

EXPECTED DURATION FROM START UP: 9 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Define the barriers to expeditious review of applications for land applying candidate materials otherwise destined for disposal.	MOEE - WRB	SWUC, OFIA, CCC, MOEE - Approvals Branch, Program Development Branch, Min. of Natural Resources, AMRC
2.	Identify opportunities for amending the current approvals process to enable expeditious review by staff responsible for application review.	MOEE - WRB	
3.	Identify opportunities to streamline approval process for acceptable waste derived mulch products (eg. leaves, clean wood). Develop proposal, undertake consultation and obtain final approval.	MOEE - WRB	
4.	Develop a simple and helpful guide to proponents of land application for reference in completing this application for approval.	MOEE - WRB	

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
5.	Communicate clearly to target stakeholders how the revised approvals system can be used effectively to compress the timetable for application review.	MOEE - WRB	

ACTION PLAN NO.2 **DEVELOP A GUIDELINE FOR OBTAINING CENTRAL COMPOSTING FACILITY APPROVAL**

PURPOSE: The purpose of this action plan is to clarify the approval requirements for central composting facilities and to ensure consistent application of the review and approval process across the province. Emphasis in the guideline is to be placed on the requirements for odour monitoring and abatement.

EXPECTED DURATION FROM START UP: 18 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Survey and compile approval requirements for composting facilities both local and in other jurisdictions (waste processing sites, air emissions, water management).	MOEE - WRB/CCC	AMRC
2.	Identify key areas to be addressed by guideline. Identify appropriate format (eg. compost guideline, waste processing sites approval guidelines).	MOEE - WRB/CCC	AMRC, MOEE - Approvals Branch
3.	Prepare discussion document. Identify key stakeholders. Undertake consultation.	MOEE - WRB/CCC	MOEE - Approvals Branch, AMRC, RCO, ALOHA, AMO, MEA, OEN
4.	Develop guidelines. Publish.	MOEE - WRB	
5.	Communicate clearly to stakeholders how the guidelines can be used to better plan for future composting facilities.	MOEE - WRB	CCC

ACTION PLAN NO.3 **REVISE INTERIM COMPOST GUIDELINE**

PURPOSE:

The purpose of this action plan is to clarify and update information presented in the existing guideline and to address new issues of importance.

All composting operations and compost produced in the province must comply with the conditions of the "Interim Guidelines for the Production and Use of Aerobic Compost in Ontario, November 1991". The guideline includes information on: approvals and permits, siting, monitoring, operating requirements and compost quality.

It was recognized at the time of drafting, late 1990, that available information was incomplete and certain sections of the guideline would require development at a later date. The incompleteness of the guideline, particularly in the areas of compost quality determination and monitoring can lead to market uncertainty and inconsistent operator requirements across the province. Additional information in the interest areas has become available since 1990. The appropriate portions of the guideline should be updated.

EXPECTED DURATION FROM START UP: 20 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Identify components of existing guideline which require clarification or updating. Identify new areas to be covered by guideline and rationale.	MOEE - WRB	CCC
2.	Identify info required, available and research needs for each component. Develop recommendations for research.	MOEE - WRB	CCC
3.	Prioritize components on basis of environmental protection needs, user requirements and info availability.	MOEE - WRB	CCC, AMRC

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
4.	Develop action plans for priority components. Action plans must refer to ongoing CCME process to develop federal guidelines for compost quality and Agriculture Canada process to revise regulations under Fertilizers Act.	MOEE - WRB	CCME (Env. Canada), Ag. Canada
5.	Develop discussion document(s) where appropriate. Identify key stakeholders. Undertake consultation.	MOEE - WRB	MOEE - Standards Development Branch, CCC, AMRC, RCO, OMAFRA, MEA, ALOHA
6.	Develop guidelines. Publish.	MOEE - WRB	MOEE - PACS
7.	Communicate guideline improvements.	MOEE - WRB	MOEE - PACS

ACTION PLAN NO.4 **DEVELOP HEALTH AND SAFETY GUIDELINES FOR COMPOST FACILITY OPERATORS**

PURPOSE: The purpose of this action plan is to develop guidelines for owners and operators of composting facilities which would ensure that potential hazards to the health of compost facility workers are minimized. The guideline would provide strategies for mitigating the effects of chemical (organic compounds) and biological (bacteria, fungi) hazards specific to composting operations.

EXPECTED DURATION FROM START UP: 9 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Develop draft guideline.	Ministry of Labour	MOEE - WRB
2.	Develop and implement consultation plan.	MOEE - WRB	CCC, ALOHA, AMRC, MEA
3.	Revise and publish guideline.	Ministry of Labour	MOEE - WRB

ACTION PLAN NO.5 **COMPILE BACKGROUND INFORMATION ON THE STATUS OF MUNICIPAL BYLAWS FOR THE DISPOSAL OF ORGANIC WASTES AND DEVELOP A PROCESS TO INVOLVE ALL POTENTIALLY AFFECTED STAKEHOLDERS**

PURPOSE: The purpose of this action plan is to compile background information which will be used to develop a process to reduce the disposal of selected organic wastes in municipal landfills.

EXPECTED DURATION FROM START UP: 9 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Obtain information from municipalities who have implemented some restrictions on collection/disposal of leaf and yard wastes and food wastes from the residential and/or IC&I sectors. This information will include: copies of municipal bylaws; background information on the local conditions which led to this decision; what alternatives to disposal were made readily available to the residents and the IC&I sectors; documenting the issues, concerns, successes and barriers the municipalities faced in implementing these restrictions and how they dealt with the concerns of affected stakeholders.	AMRC	Organic Waste Generators
2.	Compile a report on the status of these initiatives in Ontario.	AMRC	
3.	Invite potentially affected stakeholders to review and comment on the report. Document their concerns along with the report.	AMRC	
4.	Revise the report as required and circulate to interested stakeholders.	AMRC	

TRAINING AND OPERATIONS

ACTION PLAN NO.6 **DEVELOP A LEAF AND YARD WASTE COMPOSTING SITE OPERATORS MANUAL**

PURPOSE:

The purpose of this action plan is to provide managers and operators of leaf and yard composting sites with the information necessary to operate the site successfully. Currently there are more than 100 municipal programs to collect leaf and yard waste for diversion. Most programs compost the collected material. Under the 3Rs regulations additional municipalities will be required to provide central composting for leaf and yard waste.

Centralized composting of leaf and yard wastes is new to Ontario. Operational experience is very limited. Improper management of composting sites and collection depots can lead to poor compost quality and to negative off site impacts, especially odours.

The AMRC has received MOEE funding to develop two related documents: i) "Yard Waste Composting Study" which was published in the spring of 93, and ii) "Operations Manual for Leaf and Yard Waste Composting Sites and Collection Depots".

EXPECTED DURATION FROM START UP: 6 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Compile available information on management of leaf and yard waste composting sites in Ontario and other jurisdictions.	AMRC	MOEE - WRB, CCC
2.	Identify key components of manual and circulate for comment.	AMRC	MOEE - WRB, CCC, ALOHA
3.	Develop terms of reference for writing team to consist of experienced municipal site operators and scientific/technical resource people.	AMRC	Writing Team

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
4.	Complete draft document as per direction from Writing Team.	AMRC	Writing Team
5.	Solicit comments on draft from target municipalities.	AMRC	Writing Team
6.	Finalize document.	AMRC	
7.	Communicate availability of document and how it can be used to improve leaf and yard waste composting site operations.	AMRC	MOEE - PACS

ACTION PLAN NO.7 IMPLEMENT OPERATIONS TRAINING FOR LEAF AND YARD WASTE COMPOSTING SITES

PURPOSE:

The purpose of this action plan is to provide operators of leaf and yard waste composting sites with training necessary to ensure that these facilities are properly operated.

Leaf and yard waste composting is new to Ontario. Most existing leaf and yard waste composting sites are less than two years old. The 3Rs regulations will require additional municipalities to have access to these facilities.

Many existing sites are being managed by persons with little formal training in composting. Proper site management is essential to produce a high quality end product and in preventing negative off-site inputs, especially odours.

In Action Plan No.6, the AMRC will develop a site operators manual for leaf and yard waste composting sites. The training course curriculum will be based on the knowledge presented in that document.

EXPECTED DURATION FROM START UP: 6 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Identify key components (modules) of course curriculum. Circulate to key municipalities for comment.	AMRC	AP No. 6, Writing Team, key municipalities
2.	Develop curriculum materials.	AMRC	Writing Team
3.	Deliver 2-3 trial sessions in fall of 1994. Solicit suggestions for course improvements from participants.	AMRC	

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
4.	Finalize curriculum materials as required.	AMRC	Writing Team
5.	Develop plan for future delivery.	AMRC/MOEE - WRB	CCC, OETC, MOEE - HRB

ACTION PLAN NO.8 **DEVELOP OPERATIONAL GUIDES AND TRAINING PROGRAM FOR MID-SCALE ON-SITE COMPOSTING**

PURPOSE:

The purpose of this action plan is to develop information essential to the successful implementation and on-going operation of on-site composting programs. Currently little program management information/experience exists. As well, in most situations those responsible for the program will not be waste management professionals.

The required information and experience is to be gained by monitoring existing programs and by initiating demonstration projects where appropriate. Based on this information, manuals and training programs for both the IC&I and residential sectors can be provided to building management, landscape professionals and other target groups.

EXPECTED DURATION FROM START UP: 18 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Collect available information on operation of on-site composting systems.	RCO/CCC	MBS, Metro Toronto, AMRC
2.	Identify candidate facilities, target groups and info needs of target groups.	RCO/CCC	BOMA, OHA, LO, AMRC, OAPPA, ALOHA, Food Industry, Resorts Ontario
3.	Develop guide information and training program.	RCO/CCC	AMRC

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
4.	Identify focus groups for review of guide and participation in trial training program.	RCO/CCC	BOMA, OHA, LO, AMRC, OAPPA, ALOHA, Food Industry, Resorts Ontario
5.	Identify and utilize opportunities to promote materials.	RCO/CCC	AMRC
6.	Deliver course on an as needed basis.	RCO/CCC	AMRC

ACTION PLAN NO.9 **DEVELOP TRAINING PROGRAM FOR HOME COMPOSTING PROGRAM COORDINATORS TO OPTIMIZE HOUSEHOLDER PARTICIPATION**

PURPOSE: The purpose of this action plan is to provide those responsible for home composting programs with the training necessary to maximize resident participation. This training program is to be based in part on the results of the model home composting projects and other innovative and successful municipal home composting projects. The objective of the training program will be to convey information on: innovative methods to achieve high levels of resident participation, methods of monitoring the sustainability of home composting and, effective methods of providing ongoing program support.

EXPECTED DURATION FROM START UP: 12 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Assemble a training curriculum based on report and other findings, Master Composter programs, bin distribution, promotion surveys.	RCO	AMRC, MOEE - WRB, select municipalities
2.	Establish focus group for participation trial course.	RCO	AMRC, select municipalities, volunteers
3.	Identify and utilize opportunities to promote course.	RCO	AMRC, MOEE - WRB, CCC
4.	Offer regional programs on an as needed basis.	RCO	AMRC

ACTION PLAN NO.10 **DELIVER TRAINING PROGRAM ON LAND APPLICATION**

PURPOSE: The purpose of this action plan is to develop and deliver a training program on land application of organic wastes to provide broader understanding by generators, haulers, consultants, government staff, and users of the utilization of organic wastes on agricultural land. In conjunction with the training program this action plan will also develop stand alone information packages on land application.

EXPECTED DURATION FROM START UP: 6 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Expand the current sludge and other waste utilization course to become a certification program for MOEE/OMAFRA staff.	MOEE - WRB	OMAFRA, SWUC, Environmental Coalition of Community Colleges
2.	Expand the other organic wastes section of the sludge and other wastes course to a training component on agricultural consideration for MOEE staff.	OMAFRA	MOEE - WRB, SWUC
3.	Develop information packages from the training components to be utilized by clients of OMAFRA & MOEE for the utilization of wet wastes on agricultural land.	OMAFRA	MOEE - WRB, SWUC, AMRC
4.	Communicate availability of information packages on how they can be used to improve land application programs.	OMAFRA/MOEE - WRB	

ACTION PLAN NO.11 **DEVELOP A LAND APPLICATION TRAINING PROGRAM FOR FARMERS**

PURPOSE: The purpose of this action plan is to develop and deliver a specialized training program for farmers on the utilization of organic wastes on agricultural land.

EXPECTED DURATION FROM START UP: 6 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Develop a curriculum for a one day pilot training program specific for farmers.	OMAFRA	SWUC, OSCIA county associations
2.	Conduct up to 6 pilot courses across Ontario with farm groups.	OMAFRA	SWUC, farm organizations
3.	Evaluate and revise pilot course materials to develop and deliver one day courses for farmers at several locations across Ontario.	OMAFRA	SWUC, local farm organizations

EDUCATION AND PROMOTION

ACTION PLAN NO.12 **DEVELOP AND HOST INDUSTRY SECTOR FORUMS ON WET WASTE 3RS**

PURPOSE: The purpose of this action plan is to promote 3Rs approaches, especially source reduction in the IC&I sector. Companies involved in the manufacture of food products appreciate the environmental and economic benefits of source reduction and material reuse and recycling. Many companies have implemented programs to audit and reduce their wet wastes and have realized improvements in efficiency and reduced costs as a result. To help the entire sector benefit from advances in technology and management techniques, the sector association will develop information on leading edge 3Rs approaches and create opportunities for individual companies to receive and share information.

EXPECTED DURATION FROM START UP: Ongoing

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Determine member needs, develop focus areas, compile information.	Food Industry	MOEE - WRB
2.	Host forum.	Food Industry	MOEE - WRB
3.	Compile results of discussion, outstanding issues, areas for future focus etc. Publish results.	Food Industry	MOEE - WRB

ACTION PLAN NO.13 **DEVELOP AND IMPLEMENT A PROMOTIONAL PLAN FOR HOME COMPOSTING**

PURPOSE: The purpose of this action plan is to develop innovative promotional tools in support of home composting. Future promotional activities will be focussed in two areas: i) supporting households currently composting and ii) increasing the interest and awareness of households not currently composting. These tools will assist program managers in achieving maximum participation in home composting.

EXPECTED DURATION FROM START UP: 6 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Area 1: Provide Support for Households Currently Composting - update home composting resource kit - develop program of seasonal composting tips - survey composting activity at public school level and assess need for composting information.	RCO	RCMA, MOEE - WRB, MOEE - PACS, AMRC
2.	Area 2: Develop Methods to Increase Interest and Awareness of Households not Currently Composting: i) develop profiles of "non-composters" ii) identify methods/opportunities to interest/motivate iii) develop and implement components of promotional plan.	RCO	RCMA, MOEE - WRB, MOEE - PACS, AMRC

ACTION PLAN NO.14 **DEVELOP COMMUNICATION PACKAGES ON CENTRAL COMPOSTING**

PURPOSE:

The purpose of this action plan is to provide information on central composting to various target groups, including decision-makers (provincial, municipal), industry, general public and the media.

Recent experience has shown that opposition to siting composting facilities is often the result of lack of familiarity with composting and its role in waste management, poor communications between the facility proponent or operator and the community, and misconceptions regarding health and environmental risks associated with composting facilities.

Developing communications programs on composting for target audiences can help address local concerns and result in increased acceptance in the community.

EXPECTED DURATION FROM START UP: 18 months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Identify issues and target groups which need to be addressed through education.	CCC/AMRC	AMO, MOEE - WRB
2.	Develop appropriate vehicles to deliver messages.	CCC/AMRC	AMO, MOEE - WRB, MOEE - PACS
3.	Test communications through trial in select municipalities.	CCC/AMRC	
4.	Implement communication programs.	CCC/AMRC	AMO

ACTION PLAN NO.15 **DOCUMENT RESULTS OF MODEL HOME COMPOSTING DEMONSTRATION PROJECTS**

PURPOSE:

The purpose of this action plan is to develop and document effective methods of increasing and sustaining participation in home composting and to measure costs and impact on diversion. Providing this information to municipalities will increase awareness of incentives to undertake intensive home composting programs.

In 1992, nine communities received MOEE funding to undertake model home composting projects. Each community established a goal for resident participation and developed unique approaches to program promotion composter distribution and ongoing support. The WRB provided detailed reporting requirements for background information, ways and means, householder acceptance and quantified results in the areas of participation levels, impact on diversion and costs. Final results from all communities were received in January 1994.

The RCO has been contracted to produce a summary report comparing and contrasting the approaches developed by each community and analyzing the results achieved. The target audience for this report will be municipal decision makers and waste management staff.

EXPECTED DURATION FROM START UP: 6 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Develop terms of reference for summary report and schedule for delivery.	MOEE - WRB	
2.	Prepare draft summary report.	RCO	MOEE - WRB
3.	Coordinate comment from key stakeholders.	MOEE - WRB	AMRC

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
4.	Produce final document.	RCO	MOEE - WRB
5.	Develop communication and distribution plan for document release.	MOEE - WRB	MOEE - PACS

ACTION PLAN NO.16 **DEVELOP A HELPFUL REFERENCE GUIDE ON ORGANIC DIVERSION INITIATIVES**

PURPOSE: The purpose of this action plan is to provide helpful information to those interested in organic diversion initiatives that will further promote the 3Rs. The reference will be a consolidation of information on key initiatives primarily but not exclusively located in Ontario, sources of assistance (ie. technical and financial) and a summary of ongoing R&D.

EXPECTED DURATION FROM START UP: 9 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Inventory organic diversion related activity in Ontario as outlined above in the stated purpose.	MOEE - WRB	CCC, AMRC, RCO, OMAFRA, Ag. Canada, MBS, key generating sectors
2.	Develop a common format to document a common set of variables for each major category of information.	MOEE - WRB	CCC, AMRC, RCO
3.	Develop an outline for a reference guide targeted at key stakeholders in Ontario.	MOEE - WRB	
4.	Gather reference information from key sources.	MOEE - WRB	CCC, AMRC, RCO, OMAFRA, Ag. Canada, MBS, key generating sectors
5.	Prepare the reference guide and widely circulate the document to key Ontario stakeholders.	MOEE - WRB	

ACTION PLAN NO.17 **IMPLEMENT A COMMUNICATIONS PLAN TO INCREASE AWARENESS OF ON-SITE COMPOSTING**

PURPOSE: The purpose of this action plan is to increase awareness among key stakeholders of on-site composting as a method of organic waste diversion.

Several multi-residential and institutional on-site composting facilities exist in the province. However, awareness of the various methods available and potential benefits of on-site composting are not generally well known. The communications plan will target key stakeholder groups such as food industry sectors, property management companies, private institutions (retirement homes) etc.

EXPECTED DURATION FROM START UP: 9 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Compile available materials on on-site composting.	RCO	AMRC, MBS
2.	Develop information package including case histories, success stories etc.	RCO	MOEE - WRB, MOEE - PACS
3.	Identify target agencies. Circulate for comment. Publicize and distribute info package.	RCO	AMRC, MOEE - WRB, CCC, other environmental groups
4.	Identify and utilize opportunities to promote on-site composting through periodicals, trade journals etc.	RCO	CCC, AMRC, MOEE - PACS
5.	Session on MOC at next RCO conference.	RCO	

ACTION PLAN NO.18 **IMPLEMENT INDUSTRY SECTOR COMMUNICATION FOR ORGANIC WASTE DIVERSION**

PURPOSE:

The purpose of this action plan is to provide individual members of key organic waste generating sectors with information and support on appropriate techniques for organic waste reduction and for proper on-site management to facilitate diversion.

Key generating sectors, including food processing, grocery product manufacturing, distribution/retailing and foodservice industries, would undertake to develop two way communication between their membership and the wet waste management community.

The components of this action plan are to be developed in pace with the development of diversion infrastructure. The components of this ongoing communication includes:

- monitoring information needs of membership
- liaison with linkage agencies to acquire/develop information
- document developments in diversion systems for wet wastes and release to membership

EXPECTED DURATION FROM START UP: Ongoing

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Monitor info needs of membership.	Individually undertaken by key sectors: Food Processors, Grocery Products Manufacturers, Food Service Industry, Grocery Products Distributors/Retailers	OMAFRA, AMRC, RCO, MOEE - WRB, OWMA, CCC, AP No.16, AP No.17, AP No.20, AP No.24, AP No.26, AP No.29
2.	Liaise with linkage agencies.		
3.	Document development in wet waste diversion and report to membership.		

ACTION PLAN NO.19 **DEVELOP GUIDES FOR ORGANIC WASTE REDUCTION FOR LANDSCAPE COMPANIES, MUNICIPALITIES, OTHER HORTICULTURAL PROFESSIONALS, AND THE PUBLIC**

PURPOSE:

The purpose of this action plan is to provide detailed information on waste reduction techniques to all interested landscape managers in public/private sectors through publication(s) in trade and homeowner magazines and/or by producing a separate brochure(s).

The generation of yard waste (leaves, wood material, grass clippings, and other plants) can be reduced in the following ways. Proper soil preparation, selection of plant species, and management techniques (eg. watering, fertilizing and pest control) that optimize the growth and health of new and existing landscape plants will reduce the amount of pruning and replacement that is needed. Larger landscaped sites may have an area where all forms of yard waste can be composted or distributed for natural decomposition. Grasscycling (ie. leaving clippings on the turf area for natural reincorporation into the soil), should be encouraged for all but special, manicured turf where removed clippings should be composted.

EXPECTED DURATION FROM START UP: 9 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Develop draft guide for landscape managers.	Landscape Ontario	OGSA, OPA, ISA
2.	Circulate for comment.	Landscape Ontario	RCO, AMRC, MOEE - WRB, CCC, BOMA, OALA
3.	Develop and implement plan for release/distribution.	Landscape Ontario	
4.	Develop and distribute information on establishing and maintaining municipal grasscycling programs.	AMRC	RCO

ACTION PLAN NO.20 **CONSULT WITH STAKEHOLDERS ON THE UTILIZATION OF WET ORGANIC WASTES AS LIVESTOCK FEED**

PURPOSE: The purpose of this action plan is to identify all the stakeholders; farmers, generators, haulers, government regulators and advisors, commodity groups, business representatives, that are involved in the potential utilization of wet wastes as a beneficial source of livestock feed, and to develop best management guidelines that would encourage the use of wet wastes as livestock feed.

EXPECTED DURATION FROM START UP: 11 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Review issue and develop a list of stakeholders.	OMAFRA	
2.	Host a conference to discuss and determine the appropriate use of wet organic wastes as a source of livestock feed.	OMAFRA	MOEE - WRB, Food Industry, OFA, Beef, Poultry and Pork Producers
3.	Develop best management guidelines outlining the options for wet waste utilization as livestock feed.	OMAFRA	MOEE - WRB

MARKET DEVELOPMENT

ACTION PLAN NO.21 **DEVELOP MARKETING STRATEGY FOR COMPOST**

PURPOSE:

The purpose of this action plan is to accelerate the growth of the market for compost products.

"Closing the loop" in the context of organic waste means returning the resource to the system of production, which for most organic materials is agriculture. It is important therefore that a solid understanding of the different end markets and their influences be established.

Several agricultural and other organizations have sponsored research into the use of compost in various applications including field and green house trials. The benefits of this research must be assessed and communicated to producers and users. As well, analysis of end user requirements may identify the need for additional research of this type. A compost markets group, comprised of users and producers of compost, will be able to identify their specific needs and address the market influences which will encourage market development.

EXPECTED DURATION FROM START UP: 12 months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Establish group, involving representation from both compost producers, current and potential users.	CCC/AMRC	Landscape Ontario, MOEE - WRB, OWE, OMAFRA, Ag. Canada, OFA, Ont. Horticultural Society, compost facilities, organic growers' organization
2.	Determine market influences, including product, product quality, packaging, promotion, pricing.	CCC/AMRC	
3.	Facilitate the identification of market development opportunities and appropriate industry action which can address them.	CCC/AMRC	
4.	Distribute periodic update on compost market developments, including sales influences and pricing.	CCC/AMRC	

ACTION PLAN NO.22 **DEVELOP AN INFO PACKAGE ON THE USE OF COMPOST IN AGRICULTURE**

PURPOSE: The purpose of this action plan is to develop an information package for farmers, haulers, generators, and government staff to help them to understand and assess the benefits of utilizing the various types of compost on agricultural lands.

EXPECTED DURATION FROM START UP: 6 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	SWUC to designate a committee to develop the needs for agricultural users of compost.	OMAFRA	SWUC, MOEE
2.	Finalize the information needs and have a report available for clients.	OMAFRA	MOEE, SWUC

TECHNOLOGY DEVELOPMENT / R&D

ACTION PLAN NO.23 **PREPARE A COMPARATIVE SUMMARY OF RESIDENTIAL ORGANIC COLLECTION INITIATIVES**

PURPOSE:

The purpose of this action plan is to provide municipalities with a wet waste diversion planning tool based on the results of wet/dry pilot projects undertaken in Guelph, Mississauga, Metro Toronto and Halton, and other collection initiatives undertaken in Markham, Essex, Windsor, Kingston Township and other jurisdictions.

Each project is unique in approach and type of collection system tested. In each case, the project includes extensive documentation of experiences and results achieved. However, no comparative study has yet been made of this information. This information would be a useful tool for municipalities planning diversion programs for organic wastes.

EXPECTED DURATION FROM START UP: 12 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Collect published results of residential organic collection pilot projects.	MOEE - WRB	Municipalities, AMRC
2.	Develop terms of reference for project and content of report (to include identification of future research needs).	MOEE - WRB	AMRC
3.	Develop document.	AMRC	
4.	Review and comment on work in progress and final report.	MOEE - WRB	AMRC
5.	Develop plan for communication publication, distribution of report.	MOEE - WRB	MOEE - PACS, AMRC

ACTION PLAN NO.24 **DEVELOP A "GOOD PRACTICES HANDBOOK" ON IC&I ORGANIC WASTE MANAGEMENT**

PURPOSE: The purpose of this action plan is to provide information to key IC&I sectors required to advise individual members on proper on-site management techniques. Currently little information is available on the storage and handling of separated organics because it is a recent phenomenon in the IC&I sector. The food services and grocery industries need a helpful guide for the proper storage and handling of their organics in order to deal with potential problems such as odour, leachates and sanitation. This action plan will provide background information to support the development of a "good practices handbook".

EXPECTED DURATION FROM START UP: 18 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Establish partnership between organic waste generators.	MOEE - WRB	Food Industry, OWMA, OWE,
2.	Evaluate existing guidelines and identify those components that need further expansion and explanation. Review existing composting facilities and end markets.	MOEE - WRB	Food Industry, OWMA, OMAFRA, OWE
3.	Review existing industry specific guidelines, challenges, barriers and successes.	MOEE - WRB	Food Industry, OMAFRA
4.	Draft guidelines for proper storage and handling.	MOEE - WRB	
5.	Circulate draft guidelines for review and comment.	MOEE - WRB	Food Industry
6.	Publish guidelines for general distribution through association memberships, newsletters and resource centres.	MOEE - WRB	

ACTION PLAN NO.25 **DEVELOP INFORMATION ON ODOUR ABATEMENT METHODS FOR CENTRAL COMPOSTING FACILITIES**

PURPOSE:

The purpose of this action plan is to develop information that will assist operators of central composting facilities to prevent and abate odours. It is likely that all composting facilities will occasionally generate some odours. The negative impact of these odours can be minimized by reducing the frequency of occurrence (prevention) and the duration and intensity (abatement).

Maintaining proper process conditions is the best way to avoid odours. A systematic approach for identifying the odours compound and point of generation is required. Several abatement methods currently exist ranging from windrow techniques to technological systems. The effectiveness of these methods in specific situations should be measured.

EXPECTED DURATION FROM START UP: 12 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Collect existing information on odour generation and abatement methods.	MOEE - WRB/CCC	AP No.2
2.	Develop terms of reference including key components of odour source identification and abatement methods.	MOEE - WRB/CCC	MOEE - Science & Technology Branch
3.	Develop document for use by compost facility operators.	MOEE - WRB	CCC, AMRC
4.	Identify specific facilities to review document for usefulness and completeness.	MOEE - WRB	CCC
5.	Publish document.	MOEE - WRB	
6.	Communicate purpose and utility of document to stakeholders	MOEE - PACS	MOEE - WRB

ACTION PLAN NO.26 **IMPLEMENT BROADER RANGE OF MID-SCALE ON-SITE COMPOSTING PILOT PROJECTS**

PURPOSE:

The purpose of this action plan is to develop accurate information on the cost/benefit of on-site composting in key IC&I sectors.

Several on-site composting facilities have been established in other than residential establishments. Most notably, Management Board Secretariat has established a number of facilities in government institutions (hospitals, correctional facilities etc.). To interest the private sector in on-site composting, it must be shown that an economic incentive exists. The plan involves collecting and assessing available information, identifying a suitable IC&I generator, developing terms of reference for a demonstration, obtaining appropriate support, and installing and monitoring the performance of the system. The plan also includes documenting and distributing relevant information.

EXPECTED DURATION FROM START UP: 18 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Collect and review available information. Identify gaps.	MOEE - WRB	RCO, MBS, CCC, AMRC
2.	Develop scope, objectives and other key parameters for demonstration project.	MOEE - WRB	RCO, CCC, AMRC
3.	Identify and approach suitable generator (hotel, restaurant etc.) for demonstration.	MOEE - WRB	RCO
4.	Prepare project proposal including monitoring program and support requirements. Submit proposal.	Proponent	MOEE - WRB
5.	Implement and monitor project. Report results.	Proponent	

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
6.	Review and finalize report.	MOEE - WRB	RCO, CCC, AMRC
7.	Develop communication plan to promote lessons provided from demonstration.	MOEE - WRB	

FUNDING AND ECONOMICS

ACTION PLAN NO.27 **DEVELOP RECOMMENDATIONS FOR ALTERNATIVE MECHANISMS TO SUPPORT FUTURE EXPANSION OF HOME COMPOSTING**

PURPOSE: The purpose of this action plan is to develop recommendations for alternative methods of supporting future expansion of home composting infrastructure. MOEE capital funding for home composters has greatly accelerated the growth of this activity in the province thus far. Given the levels of householder participation achieved and recent regulatory developments, which provide for direct and indirect incentives for home composting, it may be appropriate to examine a broad range of alternative mechanisms including recommending changes to the MOEE's existing funding programs.

EXPECTED DURATION FROM START UP: 6 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Prepare suggested recommendations for alternatives to existing MOEE capital funding programs for home composting.	AMRC	
2.	Circulate for comment	AMRC	RCO, CCC, RCMA, AMO, select municipalities
3.	Finalize and submit to MOEE	AMRC	

ACTION PLAN NO.28 **DEVELOP INFORMATION ON THE ECONOMICS OF CENTRALIZED COMPOSTING AND ON VIABLE MODELS FOR PUBLIC - PRIVATE FINANCING, OWNERSHIP AND OPERATION**

PURPOSE:

The purpose of this action plan is to provide municipalities and private sector interests with the best available information on the costs of proven centralized composting systems and alternative models for public-private sector co-operation on facility financing, ownership and operation.

In a number of areas of public infrastructure development, roadways, water and wastewater treatment etc., traditional development models based entirely on public resources are being replaced by innovative schemes involving both public and private sector interests. These alternative models often provide for more rapid development as often opportunities exist to resolve difficult issues such as capital investment and guarantees for long term viability.
The deliverables resulting from this action plan may included published materials and/or workshops.

EXPECTED DURATION FROM START UP: 9 months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Identify economic variables associated with running a centralized composting facility, including siting, EPA approvals, financing, construction and operation.	CCC/AMRC	MOEE - WRB, AMO, Industry including haulers, generators, processors
2.	Source economic case studies (based on existing facilities both within Ontario and beyond) that will provide financial data points. (Municipal waste management master plans may be a good source for this information).	CCC/AMRC	OWMA, ORCA, U.S. Composting Council, AMO, individual municipalities

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
3.	Develop theoretical financing models where no working model exists.	CCC/AMRC	
4.	Compile and distribute information to target groups, highlighting how various financing models could be used to accelerate the development of centralized composting infrastructure.	CCC/AMRC	

DATA AND INFORMATION SYSTEM

ACTION PLAN NO.29 **ESTABLISH INFORMATION COLLECTION/DISSEMINATION NETWORK**

PURPOSE:

The purpose of this action plan is to establish a readily-accessible information retrieval service that will provide up-to-date information on compost developments, research and issues.

Currently, an information service is of value to composting interests in order to be able to access most current scientific and technical info and respond to issues as they arise.

The Composting Council of Canada is focusing resources on establishing an integrated, computerized database covering its current holdings (membership profiles, composting facilities, research projects, scientific papers). Through the accessing of other electronic networks, the system will be able to retrieve composting information from international as well as national sources. Linkages to this database will likely require computer equipment and associated software. The range of information as well as the cost for access is currently under review.

EXPECTED DURATION FROM START UP: 12 months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Compile preliminary listing of information categories currently available.	CCC	ORCA, U.S. CC, Research facilities, AMRC, RCO, MOEE - WRB, AMO
2.	Identify information and service needs of the client group.	CCC	Info Users Group, AP No. 28
3.	Establish info system and integrate information.	CCC	

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
4.	Communicate availability of info service and directions for use.	CCC	
5.	Up-date information (ongoing).	CCC	Info Users Group

ACTION PLAN NO.30 **ESTABLISH INFO USERS GROUP**

PURPOSE:

The purpose of this action plan is to facilitate the development of an information network by establishing a focus group of key composting information providers and users.

The objectives of this group will be to:
- identify types of information and services required
- provide or suggest possible sources of information
- identify specific areas for info development and suggest lead agency(s).

This group would meet 2-3 times annually over a two year period or as required.

EXPECTED DURATION FROM START UP: Ongoing

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Compile preliminary listing of info categories, currently available info and sources.	CCC	MOEE - WRB, AP No.29
2.	Document group mandate. Identify key stakeholders. Establish meeting schedule.	CCC	MOEE - WRB, AMRC
3.	Facilitate meetings. Document action items. Monitor completion of action items.	CCC	Key stakeholders
4.	Complete and provide user group input to information sources.	CCC	

ACTION PLAN NO.31 **ESTABLISH TRACKING INFORMATION ON PROVINCIAL MANAGEMENT OF IC&I ORGANIC WASTES**

PURPOSE: The purpose of this action plan is to obtain and make available information on the quantities, types and current management practices for organic wastes from key generator sectors. This information is necessary to determine the demand and potential for development of specific diversion systems and to monitor progress towards diversion goals.

EXPECTED DURATION FROM START UP: 12 Months

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Compile existing information, identify gaps, implements strategies to acquire additional info.	MOEE - WRB	Key generating sectors: food processors, grocery product manufacturers and distributors, foodservice
2.	Prepare information package for stakeholder use.	MOEE - WRB	
3.	Communicate availability of information.	MOEE - WRB	

ACTION PLAN NO.32 **ESTABLISH AN ISSUE MANAGEMENT TEAM FOR CENTRAL COMPOSTING**

PURPOSE: The purpose of the action plan is to provide a forum for discussion for all stakeholders involved in generating, collecting, processing, marketing and using compost. This forum will be available for individuals to discuss any issue related to centralized composting in a timely fashion in order to promote the positive benefits of using composting as an effective organic waste diversion initiative. Items which shall be included for discussion will be odour management, finding appropriate markets and determining the best preprocessing requirements to meet those markets and dealing with the media.

EXPECTED DURATION FROM START UP: Ongoing

STEP NO.	KEY STEPS	SUGGESTED LEAD AGENCY	PROGRAM ORGANIZATIONAL LINKAGES
1.	Establish group mandate and terms of reference (where it will meet, frequency of meetings, subject areas, chair etc.)	CCC	Identified groups
2.	Identify key groups that should be represented at such a forum.	CCC	AMRC, RCO, MOEE, AMO
3.	Ask key groups to designate a representative to participate in the compost issue management group to indicate how the representative will report back to its respective association.	CCC	AMRC, RCO, MOEE, AMO
4.	Facilitate meetings.	CCC	

Chapter 5

Implementing the Proposed Actions

Implementation of the proposed action plans is the key to ensuring that Ontario continues to divert increasing quantities of organic materials from disposal. The broad collection of proposed action plans described in Chapter 4 represents consensus derived for future action among the multistakeholder group. Continued cooperation among the many participants is essential to move from a plan development phase to a new phase of plan implementation that will help Ontario achieve its waste reduction target of 50 per cent by the year 2000.

The collection of thirty two Action Plans is offered as practical advice to those agencies that are best positioned to affect change. Specific lead agencies are identified and encouraged to accept responsibility for implementing their respective plan(s) and further refining the details where necessary.

The success of this cooperative initiative to divert more and more organic materials from disposal depends upon the continued will to cooperate among participants. The first step in the plan implementation process is to accept and acknowledge a lead or supporting role in the appropriate Action Plan(s). Participants, particularly those with a lead role(s), are requested to provide "expressions of commitment". Such expressions are requested by the Ministry of Environment and Energy in the form of a letter and should include a clear acceptance of the role as lead or supporting agency, commitment to review and if necessary refine the steps and delivery timetable estimates in the proposed Action Plan(s) and finally to undertake implementation of the Action Plans. "Expressions of commitment" letters" arising from this report are requested by September 1, 1994.

The Waste Reduction Branch will continue to facilitate this partnership by coordinating the receipt and dissemination of commitment letters to all Strategy Team participants. In this way the clear intention of participating agencies will be shared. In addition, periodic progress meetings for a period of at least two years are proposed to keep interested parties up to date on joint activities and emerging 3Rs opportunities. The first progress meeting to help sustain the Strategy Team's momentum is proposed for November 1994.

Supplement
The 3Rs of Wet Waste Diversion in Ontario

S.1.0 The First Two Rs — Reduction and Reuse

S.1.1 Waste Reduction

Reduction involves activities which decrease or eliminate the production of wastes. Industrial production changes or modified consumer practices can decrease the consumption of materials and/or the quantity of waste produced.

Much of this is equal parts common sense, technical innovation and attention to customer demands. Processors have cut food wastes by implementing better storage, inventory management and handling techniques. Evaporators are used to recover solids from whey, air pollution equipment strips powdered milk from the air, and activated carbon captures corn syrup that would, otherwise, go down the drain. A machine that rubs the kernels off a cob of corn, instead of cutting them away, increases production by 25 percent and keeps valuable starches and sugars from leaking out of the cut corn.

Individual consumers can also reduce food wastes by planning meals carefully, buying only as much as is needed, and being imaginative with leftovers. Every time a shopper comes home from the grocery store, he or she shouldn't need to clean a bag-full of unwanted or spoiled food out of the refrigerator to make room for the new supplies. A bruise or a blemish shouldn't be reason enough to toss out a piece of fruit.

S.1.2 Waste Reuse

Reuse means to use a product again, in its original form, for either the same or a different purpose. In most cases, reuse entails little or no reprocessing or cleaning. The most well-known form of food reuse is the redistribution programs operated by food banks and social service organizations (these are described in greater detail in the report's coverage of Primary Use options, pages S-37 to S-43). But every cook that devises an innovative recipe for leftovers is also practicing the second "R."

Less well documented are the efforts of food processing companies to extract all the useful (and saleable) potential from their raw materials through what are, essentially, waste reuse

Restaurants strive to cut food waste

In today's tight economic times, restaurateurs may not be able to raise menu prices without losing customers; they see wet waste reduction as an opportunity to control costs and remain competitive. Restaurant owners can reduce food waste at source by keeping inventories at reasonable levels, making sure coolers and storage containers are in good shape, instituting proper handling procedures, and using only what is required.

Good planning in placing orders is the key to reducing spoilage of the produce and other perishables. In addition, the kitchen must follow recipes carefully to keep inedible failures out of the garbage. Usable trimmings should be saved for soups and menus planned to reuse yesterday's leftovers in today's special.

Not every customer has a hearty appetite and may only wish to order a half portion. This kind of service attracts customers and keeps serving staff from having to throw out plates of uneaten food. Similarly, colourful servings and arrangements, instead of inedible garnishes, cut waste.

Ontario's Waste Reduction Action Plan (WRAP) was announced by the Minister of the Environment on February 21, 1991. The plan is intended to divert from disposal, at the very least, 25% of our waste by 1992 and 50% by the year 2000 (using 1988 as a base year). The reach these targets, the province will implement a four-point plan to divert valuable resources from disposal. This involves supporting:

- strong 3Rs regulations;
- financial and technical systems for diverting materials;
- healthy markets for recovered materials; and
- public education on responsible 3Rs choices.

efforts. The ultimate goal is to produce no waste at all. For example, the advertisements for a major hog processing firm used to brag it was able to transform "everything but the oink" into consumer products. Because this approach makes good business sense, it's often overlooked by those documenting waste diversion success stories.

And there are as many success stories as there are imaginative food processing companies. Discoloured potato slices, unsuitable for scalloped potatoes, are diced into hash browns. The seeds and juice that leak out of cut green beans are made into a paste and used in soups and baby food. Cole slaw is cut finer so that more of the core and frost-damaged outer leaves can be used without affecting the taste or presentation.

The potential of the such 2Rs opportunities to divert wastes while producing viable by-products or stretching raw materials accords them a high ranking in the hierarchy of waste management. Although the reuse possibilities of a particular waste stream are site-specific, the techniques for conducting a waste reuse and reduction audit are generic, well-developed and available in other reports (selected sources of information are described in Appendix G). While emphasizing the priority to be given wet waste reduction and reuse, the remainder of this chapter will concentrate on composting and other recycling options.

S.2.0 The Third R — Recycling

Physical, chemical or biological processes are used to treat a waste stream (or separate/extract useful components) to produce the raw material needed to make a new product. In the area of wet waste diversion, recycling may involve the conversion of organic materials into animal feed or bedding, a soil amendment such as compost, methane gas or some other biofuel feedstock. The bulk of this report addresses the direct land application and composting options (from small backyard models to mid-scale on-site composters to large central composting systems.)

To be successful, a composting program normally requires: (i) a reasonable capture rate/participation rate that guarantees a reliable supply of feedstock (ii) an effective infrastructure for segregating, collecting and transporting feedstocks, (iii) a

processing system that is efficient and produces high quality compost, and (iv) the maintenance of stable markets for the derived compost. Of course, on-site composting does not demand extensive transport and the market for the compost is often found in the generator's own backyard.

S.2.1 Waste-Derived Animal Feed

Traditionally, certain by-products from commercial food production have been utilized by farmers as feed or feed supplements for swine, cattle or poultry. The relationship between generator and user has been direct and based on economic incentives (the generator avoids high landfill tipping fees while the farmer reduces conventional feed bills). To maximize this diversion option without jeopardizing the livestock industry, it will be necessary to:

(1) ensure that food wastes are used in animal feed only in ways that are consistent with animal health, product image and general good farming practices;

(2) focus diversion efforts on specific waste types in accordance with their suitability as animal feeds (based primarily on nutrient and moisture content, compatibility with other feed types, processing/cooking costs, tendency to decompose, palatability, and contamination levels); and

(3) provide waste generators and haulers with information that will enable them to source, prepare, store and deliver organics in a manner consistent with the objectives of the agricultural community.

There are three basic approaches to utilizing food wastes as animal feed: (i) the direct feeding of culled produce and other suitable material to cattle; (ii) on-farm processing (i.e., boiling) of food before it is fed to swine or poultry; and (iii) commercial processing of wastes (similar to a rendering operation) to produce a dry feed supplement.

Use of human food wastes for animal feed is governed by the federal Health of Animals Act and Regulations, administered by Agriculture Canada. The regulations only cover the feeding of edible food wastes to poultry or swine, and state that food waste must be boiled before feeding. In addition, the licensed feeder must own the swine or poultry and cannot transport or sell the processed food.

Garburetors will not solve Ontario's wet waste problems!

Household garburetors are small electrical appliances, usually attached to the kitchen sink, that are used to grind vegetable peelings, plate scrapings and other kitchen scraps before they are flushed down the drain. The fate of the bulk of these wet wastes is the biological treatment tanks at the local sewage treatment plant, followed by removal of the resultant sludge, dewatering and, then, either incineration, land application or landfilling.

Many waste management experts believe garburetors waste energy and water, and may place an undue strain on a community's sewage treatment plant. Sewage treatment plants also have difficulty handling the heavy organic nitrogen content found in concentrated loadings of wet waste.

Major upgrading efforts may be required if a facility has not been designed to handle the output from residential and/or IC&I garburetors. While this may reduce the direct pressure on municipal landfills, it does not make either environmental or economic sense to intentionally add contaminant-free wastes to a wastewater flow that may include significant levels of contamination. Composting, done either centrally or on-site, can be a more cost-effective diversion option that also conserves and recycles the nutrient value and other soil amendment properties of the feedstock.

Sources of waste-derived animal feed are usually large processors, within reasonable shipping distance, who can guarantee the quality (and low contamination levels) of the material. In order of their desirability or suitability, the categories of food wastes most amenable to animal feed programs are:

- cookies, crackers, pasta, oil meal (soybean, canola and sunflower), confectionery and other "dry manufacturing" materials;
- dairy, brewery, distillery and other "wet manufacturing" materials;
- vegetable canning, potato chip and other processing wastes;
- onions, carrots and other packaging industry culls; and
- restaurant and hotel post-consumer wastes.

Health inspectors visit farms utilizing waste-derived feed on a biweekly basis to ensure that minimum standards are maintained. Currently, there are 18 swine and poultry operations licensed in Ontario. Agriculture Canada excludes some food wastes from the requirements of the Act. Wastes that do not contain meat and which do not pose a threat to livestock health, such as vegetable culls and bakery wastes, may be exempted on a case-by-case basis. A number of cattle farmers receive this type of material for direct feeding.

Businesses that process food wastes for the purpose of marketing an animal feed supplement are designated as "feed manufacturers" under the Canada Feeds Act and must comply with the relevant provisions of that legislation. The Act and its regulations set proper labelling, nutrient guarantees and safety assurances for commercially prepared feed supplements.

The relevant provincial regulatory provisions, under the Environmental Protection Act, exempts from the Part V approval requirements those facilities that wholly incorporate wastes (classified as Recyclable Materials) into an end-product. Currently, farms that receive organic wastes for the purposes of animal feeding are not required to obtain a Certificate of Approval as a disposal site on the grounds of the recyclable material exemption.

Current animal feed operations

This is not a recent innovation in recycling. For example, one Ontario producer has been feeding his swine waste-derived animal feed since 1976. Every week, his 5,000 hogs go through 400 to 700 tonnes of candy, sour milk, brewery wastes, soup, vegetables, dog and cat food, gum, donuts and hotel wastes. A Georgetown cattle farmer has been feeding his stock pasta, brewers grain, old bread and other dry foods for the past 25 to 30 years.

Although comprehensive diversion figures are not available, there is generally a strong demand for good quality waste-derived feed. Cattle and pig farmers may pay between 30 and 50 percent of the cost of conventional feed to suppliers of acceptable waste-derived animal feed. Farmers may accept wet wastes of lower nutritional value (such as prepared food wastes) for a fee.

Pressure to recycle food wastes through animal agriculture is strong and will continue to grow; increasingly, livestock producers are being viewed as a recycling option. Producers that may be potential users for human food wastes include those located close to: food manufacturing or processing operations, areas of high population density, or regions charging high landfill tipping fees. The future expansion of the animal feed options will depend on:

- the cost of corn and other conventional feed sources;
- the distance to sources of food wastes and transportation costs;
- the consistency and reliability of supplies of waste-derived animal feed;
- the palatability, nutritional consistency, contamination levels (such as plastic wrappers, twist ties, metals, etc.) and shelf-life of waste-derived animal feed;
- the effects of waste-derived feed on animal growth and meat quality;
- the ability of the farmer to cover start-up costs for specialized storage, cooking and feeding equipment;
- the establishment of central collection and processing facilities;
- consumer perceptions of the quality of meat products from stock that have been fed waste-derived feed;
- information programs to educate potential suppliers and users; and
- the future cost of waste disposal.

S.2.2 Rendering

Rendering is a process whereby organic wastes are reprocessed into "value-added" products such as tallow (used in the production of soap and toiletries) and bone meal (a livestock feed supplement). Hot water or steam (under high pressure) is used to separate fats from protein, connective tissue and other water-insoluble materials found in animal carcasses and other food-processing wastes.

While rendering operations can accept virtually all organic wastes, preferred feedstocks include meat, poultry and fish processing wastes, as well as other fats, oils and greases from the food services sector. Rendering is a well established industry. There are six facilities currently operating in Ontario that have been diverting organic wastes from disposal for many years.

Movenpick Restaurants

of Switzerland has imported many proven 3Rs programs to its Yorkville, Toronto, operation. In conjunction with the Ontario Restaurant Association, the City of Toronto and Metro Works, the restaurant took part in a pilot-scale "blue box" recycling program in 1990. Based on that success, Movenpick now separates all its wet wastes. The food scraps, including meat products, are picked up every day by a local pig farmer at a cost to the restaurant of $1,000 a month. It used to cost $2,000 more a month to use a private waste hauler. Today, all you will find in Movenpick's garbage cans are non-recyclable paper and plastic.

S.2.3 The Direct Land Application of Wet Wastes

Land application programs may be used to improve the following types of land uses:

- **agricultural lands, by improving properties relevant to crop growth;**
- **silviculture operations, such as tree farms, reforestation sites, etc.;**
- **non-agricultural lands; and**
- **pits, quarries and land tailings sites.**

Beneficial direct land application (DLA) is one of the simplest biological treatment methods available. DLA differs from "land farming" or land spreading (in which organic wastes are spread on dedicated sites to exploit the assimilative capacity of the soil); the primary objective of DLA is soil improvement, while the other are waste disposal activities.

While diverting wet wastes from landfill, DLA programs return natural nutrients and other beneficial materials to the land and help ensure the long-term health of the soil. Intensive farming practices are gradually reducing the organic matter content of Ontario's soils. DLA may help reverse this trend; wet wastes can benefit crop production by:

- increasing the macro-nutrient (nitrogen, phosphorus and potassium, also know as NPK) and micro-nutrient (such as calcium, magnesium, boron, manganese, etc.) content of soils;
- contributing additional organic material to the soil;
- improving soil moisture;
- retarding soil erosion; and
- adjusting the soil pH to a range suitable to the planned crop(s) or groundcover(s).

However, if improperly applied, wet wastes can result in ground and surface water contamination (through run-off or leaching), and in lower crop yields as the degradation of the wastes competes with crops for nutrients.

The Recycling Council of Ontario (RCO)

is a non-profit corporation of government, industry and community groups that encourages 3Rs programs and policies. Among other initiatives, the RCO promotes home and small-scale, on-site composting, publishes "The Composters' Journal," operates an information hotline, and offers "how-to" and "training the trainer" composting courses.

Land application involves spraying, spreading, injecting or plowing liquid wastes, sludges or shredded wet wastes into the upper 15-20 centimeters of the soil. The wastes are then adsorbed on soil particles, and biodegraded by naturally occurring micro-organisms, or otherwise transformed physically, chemically or biologically. Nutrients (particularly nitrogen and phosphorus) and pH conditions may be manipulated to increase the efficiency of the process.

One of the features that makes DLA so attractive is its low cost, compared to landfilling and other disposal options. The technology is well developed, relying on many of the soil preparation techniques and systems commonly used in agriculture. Food processing wastes (from canning and freezing operations and from milk processing), leaf and yard wastes, culled fruits and vegetables, paper and sewage sludges, bark

residues, and other homogeneous organic wastes may be recycled through direct land application.

S.2.4 Limits on Direct Land Application

There are two primary factors which limit the direct land application of wet wastes: some municipalities have prohibited the practice by law, and adequate storage may not exist to stockpile wet wastes until they may be spread under favourable conditions. Wastes must be stored for up to six months if the following conditions persist:

- winter and frozen soil conditions (liquid wastes will freeze on the surface - when they melt, the runoff may contaminate surface waters or pool in depressed areas);
- wet conditions (the vehicles applying wastes may compact soil);
- the presence of growing crops; or
- hot humid weather (which may lead to odour problems).

S.2.5 Not all wet wastes are suitable for DLA

The suitability of an organic waste stream for land application depends on its innate benefits to crop production, its concentrations of metals or other contaminants of concern, and its potential for producing odour problems or spreading pathogens. It must also be reasonably homogeneous in quality. Each feedstock source must be evaluated on its own merits. Not all wet wastes are beneficial to agricultural soils; for example, municipally-collected leaves which contain a large proportion of oak and walnut leaves or coniferous needles may have undesirable effects.

The OMAFRA/MOEE's "Guidelines for Sewage Sludge Utilization on Agricultural Lands," updated and issued in October, 1992, help in determining the suitability of municipal sewage sludges for land application. Of the estimated seven million cubic metres of sewage sludge generated in Ontario each year, approximately 1.2 million cubic metres are applied to land. The remainder is incinerated and landfilled.

DLA activities are expanding to include the application of leaves, culled fruits and vegetables, food processing wastes and other similar materials. The land application of such materials are covered by the "Draft Interim Guidelines for the Utilization of Waste (Other than Sewage Sludge) on Agricultural

The Composting Council of Canada (CCC)

is a national, non-profit organization with a charter to advocate and advance the use of composting. The Council supports municipal and industrial composting systems, provides a national information network, cosponsors research, promotes markets for quality compost, and educates the public. The Council's objectives are pursued through conferences, a quarterly newsletter and special reports, such as their recently released "National Survey of Solid Waste Composting Operations in Canada." The CCC is currently setting up an integrated, computerized database of composting information that taps into data banks across the country and around the world.

The Association of Municipal Recycling Coordinators (AMRC)

was formed in 1987 to share information on practical and cost-effective waste reduction and recycling opportunities. AMRC members and full-time staff work together to solve common problems and present a unified voice in promoting progressive waste management solutions to industry, governments and individuals. Project-oriented committees disseminate expertise through manuals, reports, workshops and the AMRC's newsletter "For R Information."

Lands" prepared by the OMAFRA/MOEE's Sludge and Waste Utilization Committee (SWUC).

Provincial guidelines also cover: waiting periods (between sludge application and foraging/crop removal), the separation of spreading areas from other land uses, separation from groundwater and bed rock, protection from metals, soil pH limits, and the maximum metals concentrations in soils, sewage sludges and other wastes.

The challenges to expanding the use of direct land application diversion options include:

- the availability of suitable land and the relatively small "window of opportunity" for applying organic materials to fields;
- accommodating seasonal access limits that may require on-site or off-site storage for up to six months;
- maintaining consistent sludge quality so that farmers know what they are getting; and
- providing effective information to encourage farmers and waste generators to participate, overcome possible problems, and keep land application programs in the public eye.

Ways to reduce leaf and yard wastes:

- Planting alternative ground covers can cut water use & maintenance.
- The proper selection of plant species and soil preparation techniques reduces plant death.
- Grass clippings should be left on the lawn. Sharp blades on a conventional or mulching lawnmower provides for a finer, cleaner cut and produces smaller clippings that fall down between the stalks of grass.
- Lawns that are allowed to grow longer during hot summers slow the evaporation of water from the surface of the soil.

S.2.6 Mulching of Grass and Leaves

Mulching, or "grasscycling" as it is often called, is a diversion option that requires little investment in equipment or time. In fact, it may reduce landscaping costs (grass clippings don't need to be bagged; they can be left on the lawn) and is certainly more cost-effective than traditional waste disposal options. One study found that it takes 38 percent less time to cut lawns without raking and bagging.

Grasscycling helps develop a healthy "mulch" layer on lawns. Mulch is organic material, such as straw, peat moss or leaves, that is spread in a thin layer over the surface of the ground, over flower beds and around bushes, and left to decompose. Worms, insects and micro-organisms complete the process of decomposition, returning nutrients to the soil and gradually building a topsoil of humus. Mulch helps prevent evaporation and conserve water. It insulates and helps maintain an even soil temperature: cooler in summer and warmer in the winter. It also helps prevent erosion, control weeds and enrich the soil.

Grass clippings and chopped leaves both make good mulches. Either can be used on-site or gathered and shipped

for use on local green spaces or community gardens. Suggestions to improve the success of grasscycling operations include the following:

- Mow when grass is dry or, at least, not overly wet.
- Mow from the outside inward, directing cuttings towards the centre of the lawn. This ensures clippings are chopped and rechopped several times.
- Cut grass every 5 to 7 days, with a mulching mower if available. If not, keep mower blades sharp.
- Leaves can be shredded with a lawn mower (equipped with a collection bag) or an edge trimmer (in a garbage can) before being spread on gardens.

S.3.0 A Short Primer on Composting

Organic materials — such as food scraps, grass clippings and yard trimmings, sewage sludge and manure, natural cloth fibres, wood, paper, and so on — are biodegradable. That means that they can be broken down by bacteria and other organisms, usually in the presence of moisture and oxygen, into simpler, more stable compounds. While this takes place slowly and naturally, without any help from us, the process can be optimized and the end-products refined to facilitate their use. Composting, like sewage treatment, makes use of natural biological processes that are optimized within an engineered system.

According to Ontario's 3Rs Regulations, "composting" is defined as "the treatment of material by aerobic decomposition of organic matter by bacterial action for the production of stabilized humus." For the purposes of this report, the term composting refers solely to an aerobic composting process which occurs in the presence of air (i.e., oxygen).

Other processes have been developed, particularly in the area of wastewater sewage treatment, which utilize anaerobic (i.e., without oxygen) decomposition. Such processes, known as anaerobic digestion, are discussed on pages S-34 to S-36).

The aerobic decomposition of wet and other organic wastes is undertaken by bacteria, fungi and other microscopic organisms (which do most of the work), as well as mites, sowbugs, worms and other larger organisms. Micro-organisms utilize organic matter as a source of nutrients. In the process of metabolizing these materials, they decompose or break them

People have been composting organic wastes for thousands of years. However, it was not until the beginning of the 20th century that scientists began to systematically investigate techniques to improve the efficiency and versatility of the process. The science of composting is concerned with effects of temperature, air, moisture, nutrient concentrations and balance, feedstock size and homogeneity, and other environmental conditions on the speed of the process and the quality of the finished compost. Research, both in Canada and internationally, is focussed on three areas: (1) developing a better understanding of the composting process, (2) determining the conditions needed to facilitate efficient composting, and (3) determining the impacts of compost on agriculture.

Bulking agents are added to wet wastes to ensure that the pile is porous and loose enough that sufficient air can move through the composting mass to support the aerobic micro-organisms. In some cases, bulking agents are needed to soak up excess moisture or maintain the C:N ratio. Common bulking agents include:

- wood chips
- sawdust
- straw
- shredded paper and old corrugated containers
- brush & other landscape wastes

The micro-organisms in the compost pile grow best when the optimum nutrient levels of carbon and nitrogen are present. The C:N content is one tool for measuring and achieving the proper nutrient mix although the results may not accurately indicate the bio-availability of the nutrients).

Operators strive for an optimum C:N ratio of 20-30:1 in the blend of compost feedstocks. The C:N ratios of commonly composted materials:

15:1	Food wastes
20:1	Fresh grass clippings
35:1	Fruit wastes
40-80:1	Freshly fallen leaves
80:1	Dry leaves
100:1	Dry straw
500:1	Sawdust

down into simpler chemical structures and release the energy they require to grow and multiply. The end-product is a stable material, high in organic matter content, which is suitable for use as a soil conditioner.

Most wet wastes, including sewage sludge, yard and leaf wastes, and residential and IC&I food wastes, can be composted. Dilute liquid wastes may need to be mixed with a bulking agent to reduce the moisture content and improve their manageability. Aerobic processes similar to composting have also been used to treat contaminated soils, pesticides, tars and industrial sludges.

S.3.1 The Benefits of Composting

Composting provides two major benefits: it diverts wet wastes from disposal, and the compost produced can improve the soil properties necessary for crop growth. Compost and other organic matter has a profound effect on soil structure, water retention, aeration, erosion control and cation exchange capacity. It also provides a hospitable environment for beneficial soil organisms. Although compost is an excellent soil conditioner, it is not a fertilizer; compost has a relatively low nutrient (NPK) content.

- Composting conserves landfill capacity and can reduce the cost of municipal solid waste collection, trucking and disposal. Diverting wet wastes from landfills also reduces the generation of landfill methane and leachates. Composting stabilizes and sanitizes wet wastes so that they can be used in beneficial applications without the potential for negative impacts, such as odours or disease transmission.
- Composting has the potential to reduce the total quantity of residential household wastes going to landfill by up to 33 percent. The all-natural process can be accomplished in large central composting facilities, mid-scale on-site systems, single-family backyard units, and even smaller models designed to fit on an apartment balcony.
- Composting reduces the volume of the organic wastes treated by an average of 40-50 percent.
- Compost improves the texture and fertility of the soil:

aerating dense clays, binding dry, sandy soils, adding long-term food sources for plants, and improving the fertility of poor quality soils.

- Compost also improves the water-retention qualities of the soil, cutting erosion and reducing the need to water so often.
- A household producing its own compost reduces or eliminates the need to buy soil conditioners. Backyard composting empowers the individual to manage his or her own wastes in an environmentally responsible manner.

S.3.2 The fundamentals of composting

The environment of the compost pile (including moisture, temperature, C:N ratio, pH, aeration, and nutrient availability) is maintained and adjusted to encourage the biodegradation of organic wastes by aerobic micro-organisms. Odours must be minimized and leachate/runoff carefully managed.

The environment of the compost pile determines the efficiency of the process and the quality of the finished compost. Important factors include:

- **Temperature**: The temperature of the compost pile rises and falls as a succession of decomposer organisms work their way through the organic contents. In order to kill any pathogens in the feedstock, adequate temperatures (above 55°C) must be maintained for a minimum period of time, as specified in the provincial compost guidelines.
- **pH changes**: Similarly, the pH shifts from slightly acidic to alkaline to neutral as decomposition proceeds.
- **Moisture**: The micro-organisms involved in the composting process live in the thin films of water that surround the particles of wet waste. Therefore, moisture content is critical; too low and the rate of decomposition is reduced, too high and anaerobic conditions may result.
- **Size reduction**: Small particle size encourages rapid decomposition, although if the feedstock is too fine it can impede the movement of air through the pile.
- **Aeration**: Air movement must be adequate to replenish oxygen and diffuse carbon dioxide, water and the other end-products of metabolism.
- **Macro and micro-nutrients**: Organic carbon compounds

What's In ...

Backyard composters can handle fruit and vegetable cuttings, scraps and peelings, as well as coffee grounds (and filters), wool rags, egg shells, feathers, flowers, hair, garden wastes and grass clippings, grape pomace and wine-making waste, leaves, peanut shells, peat moss, pine needles, plain pasta and bread, pomace from cider presses, rope and string (but not dental floss), sawdust, seaweed and algae, shredded newspaper, soil and muck, spent hops, straw and hay, tea leaves and tea bags, weeds, and wood ash.

And What's Out ...

Only certain types of kitchen waste should go into backyard and mid-scale, three-bin composters. While digesters and commercial mechanized systems accept all kinds food wastes, backyard composters should not add meat, fats and dairy products, including: butter, bones, cheese, chicken, fish scraps, lard, mayonnaise, meat scraps, milk, peanut butter, pet faeces, salad dressing, sour cream, vegetable oil, or yogurt. Including these materials can attract flies and other pests or cause odour problems.

Backyard composting of leaf and yard wastes

In many cases, leaf and yard wastes can be biodegraded in a traditional backyard composter. Dead leaves and food wastes should be added in roughly equal amounts to maintain a proper balance of carbon and nitrogen. Overloading a backyard composter with grass clippings or food wastes can cause odour problems.

If the supply justifies it, a resident can build a separate compost pile for leaves alone, alternating six inches of leaves with one inch of soil. The composting process is accelerated if the leaves are first shredded with a lawn trimmer, lawn mower or commercial chipper. Shredded leaves can also be used as mulch on flower beds and vegetable gardens.

are an essential energy source. Nitrogen and phosphorus tend to be significant limiting nutrients (i.e., their abundance may be a determining factor in supporting growth rates). Other major nutrients are sulphur, potassium, calcium and magnesium. Important trace elements include chromium, cobalt, copper, molybdenum and zinc.

- **Compost stability and maturity**: While there are a number of analytical methods available to determine the status of the composting process, they are usually expensive and difficult to use. The process, by nature, does not proceed to completion (i.e., the complete break down of all the organic matter to simpler compounds) but approaches a steady state under ambient conditions. Mature compost is typically brown, crumbly and musty/ earthy smelling.

Composting can be conducted on the site the wet wastes are generated in single family backyard composting units or mid-scale multi-residential or institutional composting systems. Wet wastes may also be collected and composted centrally. Technologies used in both on-site and centralized composting applications include: static pile, in-vessel and turned windrow composting.

The MOEE has been financially supporting municipal home composting programs since 1987. Under the Municipal Reduction and Reuse program, administered by the WRO, the province provides two-thirds of the capital costs of buying individual backyard composters (which average about $45.00 a piece), and one-half of the operational costs needed for education and promotion efforts (although administrative charges are excluded). In the first five years, expenditures of nearly $18 million have helped place more than 700,000 composters in backyards across Ontario.

S.4.0 Backyard Composting (BYC)

Approximately three-quarters of all residential wet wastes (with the exception of meat, bones, oils and fats, pet litter and some other materials) are suitable for composting in the backyards of the very people who produce them. While making a significant contribution towards waste diversion, backyard composting also allows individuals to make a positive contribution to environmental protection.

A backyard composter provides an opportunity for residents to exercise their personal responsibility and reduce the wastes they generate. In more concrete terms, home composting also reduces the need for more expensive wet waste collection and central composting programs. And it's an on-going source of an excellent, not to mention free, soil conditioner for use on gardens, lawns and flower beds.

BYC is not difficult to master. A backyard compost project can

range from a simple pile or small pit in a corner, to rudimentary homemade bins of chicken wire or snow fence or wooden slats, to more sophisticated garbage can units, two or three-bin wooden models, and commercial plastic bins or rotating drums.

While some care is needed to avoid odour or pest problems, and making an occasional trip out to the composter through the winter snows may be a chilling experience, home composting quickly settles into the routine rhythms of home life.

S.4.1 Municipal BYC Programs

While composting offers many benefits to a household when conducted at the individual level, it only becomes an effective method of waste diversion when a significant portion of the population participates. Achieving a high level of resident participation requires intensive, coordinated efforts at the municipal level.

In 1989, Ontario municipalities, recognizing the waste diversion potential of BYC, undertook preliminary promotional programs and began to distribute subsidized BYC units to interested residents (usually by offering composters once or twice a year for pick-up at a centralized depot). While these initial efforts were cost-effective, by 1992 it became apparent that two issues had to be resolved before the full diversion potential of BYC could be realized. New methods had to be developed, first, to push resident participation rates above 20 percent and, secondly, to ensure that once the BYC was delivered, individual users continue to use them.

Innovative BYC programs in several municipalities have shown it is possible to boost participation rates up to the 80 percent level. Successful programs incorporate the following common components:

- promotion before the program begins (in order to increase awareness and interest);
- front door delivery of composting units (such personal contact provides an opportunity to assist with installation, provide instruction and increase the comfort level of users); and
- within six months of the unit's delivery, a follow-up visit by knowledgeable program staff.

The Model BYC Program

In an effort to develop the innovative promotional ideas and practical support techniques needed to encourage high levels of participation in home composting, nine communities across Ontario have participated in Model BYC Programs. The experience gained during these demonstration projects (in Brockville, Barrie, West Garafraxa, Kingston, Dryden, Cornwall, North Bay, Parry Sound and the Bluewater Recycling Association) will help other municipalities promote their BYC efforts.

To date the results have been outstanding. For example, Brockville's Model Backyard Composting Program has doubled the number of composters in the city. After just twelve months, 50 percent of households have come on board and the city's backyard composters have already taken a bite out of overall refuse generation totals.

Community gardening is well established in Europe

and going strong in North America, but community composting is just finding its feet. However, the number of joint composting/gardening initiatives are expected to grow because the two activities make such a good, symbiotic match. In Zurich, for example, apartment complexes operate self-managed, low-tech, large-container composting systems; the compost goes directly to adjoining community gardens.

YIMBY — Yes In My Back Yard

In Quinte Region, 20 percent of residents were already composting. To hit the 80 percent participation target of its YIMBY drive, officials had to convince 18,000 additional households to join the program. After just three months of intensive promotional efforts, 17,600 composters were delivered, most of them free-of-charge, right to the doors of eager composting converts. Since then, an extensive support system, that includes local "master composter" volunteers, brochures, newspaper articles and a troubleshooting hotline, have helped keep the BYC program on track.

S.4.2 On-going Education Key to BYC Success

Promotional and education efforts are necessary to raise awareness, persuade residents to accept backyard composting and, once they have set up a BYC unit, to continue to use it and use it correctly. Educational efforts can't end when the resident takes a composter home; continued support is needed to address the problems users may experience, prevent backsliding, and compensate for the transient life of the modern urban dweller. In addition to a wide range of printed and video information available, the Recycling Council of Ontario has developed training packages for: master composter training, public workshops, training the trainer to conduct public workshops, and running successful BYC programs.

It is estimated that some 600,000 Ontario households are already composting some of their kitchen, leaf and yard wastes. An estimated 35 percent of the population live in high rises and other housing where it would be difficult to take part in a BYC program (although some dedicated composters have enthusiastically embraced balcony-sized units). Experience has shown that, in terms of home composting, the general public can be divided into three categories:

(1) about 20 percent of the public are self-motivated and will participate in BYC programs with little encouragement;

(2) approximately 60 percent could be persuaded to begin home composting, given the proper incentives (for example, by teaching them about the advantages of composting, supplying them with free backyard units, or charging them a per-bag fee or other disposal charge for the garbage they put out at the curb each week); and

(3) the final 20 percent will refuse to participate regardless of the incentives offered.

Results from two very intensive BYC projects support the 80 percent upper limit for participation. Backed by dedicated door-to-door education efforts and the distribution (and delivery) of free composters, between 80 and 85 percent of the single family households in the Town of Port Colborne and Centre and South Hastings began backyard composting.

S.4.3 What is the waste diversion potential of BYC?

- There are 3.9 million households in Ontario.
- Of these, 65 percent or 2.5 million are in a position to compost in their own backyards. The remainder live in high rises or other locations that may not be amenable to BYC.
- Experience has shown that a maximum of 80 percent (or 2 million) of those households in a position to compost in their backyards are actually willing to so given the proper support and incentives.
- Each of these households generates about 330 kilograms of wet waste every year of which, normally, 240 kilograms (72 percent) is deemed suitable for diversion through backyard composting.
- Theoretically, 480,000 tonnes of residential wet wastes could be diverted each year through backyard composting (representing some 14 percent of residential wastes and 5.5 percent of Ontario's total municipal solid wastes).
- With an estimated 600,000 households already composting, the target audience for future BYC programs is 1.4 million households.
- Current BYC efforts are capturing about 30% of the reasonably-achievable, backyard-compostable total, leaving an, as yet, untapped potential of 340,000 tonnes for the backyard composters of tomorrow.

S.4.4 The future of BYC

Provincially, BYC efforts have grown rapidly since 1989. The initial rate of growth will slow unless intensive efforts, spear-headed by municipalities, are directed at residents who can be persuaded, given the proper incentives, to begin composting. Municipal decision-makers must remain convinced that the waste diversion benefits of such efforts far exceed the costs. It is recognized, however, that the incremental costs of signing on those households that are less committed to composting and waste diversion will be higher. After a certain participation rate is achieved, additional efforts may carry exponential costs.

The Ontario 3Rs regulations add legislative impetus to the voluntary efforts exhibited to date. The regulations require that municipalities with populations greater than 5,000 make backyard composters available to residents (at cost or less) and provide residents with information on composting.

How can BYC/MOC compost be used?

- as a soil conditioner
- as a "top dressing" around the base of growing plants
- placed around the bottom of trees or bushes
- sprinkled over lawns
- dug into garden soil before spring planting
- mixed with sand and soil to make potting soil
- mixed with water, stirred and steeped 5-10 minutes to make a kind of liquid fertilizer called "compost tea"

Fastfood ... for worms

A modular vermicomposter — consisting of 16 worm bins enclosed in a 2.5m by 2.5 m insulated bin — is handling the food waste from three quick-service food outlets at Toronto's Harbourfront. Some 15 to 20 kilograms of food waste are run through a motorized shredder and added to the system each day. The temperature is controlled at 22° C. Ventilation louvres allow adequate air flow. Every few months, vibrating screens are used to separate the worm casings from the worms, and the finished compost is used to fertilize flower beds in the popular tourist area.

To give the municipalities the legal powers some feel they need to encourage more residents to compost (or, more precisely, discourage the disposal of compostables and recyclables), the legislature passed the Municipal Statute Law Amendment Act in 1993. The Act amends certain waste management provisions of the Municipal Act and permits municipalities to require source separation and charge user fees for waste management services including refuse collection.

The future growth of home composting participation will depend upon: (1) convincing municipalities that intensive programs are successful and cost-effective, and (2) creating economic incentives for composting through the implementation of user fees for waste collection services.

S.5.0 Mid-Scale, On-Site Composting (MOC)

Mid-scale, on-site composting (MOC) is a relatively new concept, and a challenging frontier, in the management of wet wastes. Organics have been trucked to large, central composting facilities, shipped to area farmers as animal feed or treated in much smaller batches in the backyard composters of homeowners. Newly-refined MOC technologies mean that sizable amounts of wet waste (MOC systems are roughly defined as those that handle less than five tonnes per week) can be composted on the IC&I or residential sites where they are generated.

Schools, hospitals, office buildings, hotels, shopping centres and other IC&I sources, as well as apartments, townhouses and other multi-unit residential buildings are all suitable candidates for mid-scale, on-site composting projects.

On-site or off-site?

Materials generated by a number of immediately adjacent properties, facilities or housing units under the control of one owner and sent to a mid-sized composting facility may be considered on-site treatment. However, if such wastes must travel a public road or other property, the material is considered to be travelling off-site.

Some establishments may be able to divert most or all of their wet wastes through on-site composting. For example, 50-70 percent of the wastes from Ontario's correctional facilities are organic. On average, 12 percent of the solid wastes generated by an office building are wet wastes. Almost all the wastes from cafeterias and restaurants, once one has removed the recyclable cans and bottles and plastic materials, may be composted. The MOEE estimates that 11 percent of the province's IC&I solid wastes, comprising some 600,000 tonnes a year, are wet wastes.

In Ontario, the 2.8 million people that live in apartments, townhouses and other multi-unit residential buildings produce

an estimated 250,000 tonnes of food wastes a year. MOC demonstration projects in Barrie, Metropolitan Toronto and Waterloo have shown promising results; other Ontario communities are launching similar pilot projects to help divert from landfill this significant source of wet wastes.

The multi-unit concept is quite simple (although its application may be more complicated). Rather than each household unit being equipped with its own composting bin, residents share a larger, on-site composting system. Each tenant is responsible for separating their own wet wastes, carrying them to the composter and loading them in. Leaves, grass clippings and other landscaping wastes are also accepted. Building staff or residence volunteers maintain the system and address problems as they arise. IC&I applications, while usually handled by the building maintenance staff, still require the strong support of employees/tenants to be successful.

Education and leadership are the keys to success. Adding the wrong materials in the wrong amounts can affect the quality of the final compost, and apathy can cut participation rates dramatically. It usually takes one or two people at each site to keep the composting dream alive by indoctrinating new tenants, motivating drop-outs, answering questions and keeping things running smoothly. IC&I managers may wish to pass this job on to their in-house environment committee.

S.5.1 MOC composting systems

A number of composting systems have been tested in IC&I and residential MOC applications. Some generators have built their own two or three-bin units, while others have invested in more sophisticated commercial systems. Some sites have also purchased auxiliary equipment, such as mulchers to shred leaves for the compost pile. Each system has its advantages.

Two and three-bin systems are not designed to handle meat, bones and dairy products (some groups also discourage adding breads, cereal or cooked leftovers). However, the simple wood and wire designs, complete with their corrugated fibreglass lids, cost less than $300 to build. In addition, maintenance only takes a couple of hours each month. As the first bin fills up, its contents are turned and fresh incoming material is directed to the adjacent one. The third bin contains finished compost. A one-by-one-by-three metre unit (with three cubic

Metropolitan Toronto's MOC pilot project ...

has been running since 1990. In the first stage, 25 three-bin composters were set up in housing co-ops, privately-owned apartment buildings, a university and a community agency. Each participating group bought its own composter(s), at a special discount, from the municipality which constructed the units based on a modified design by the Recycling Council of Ontario. In addition, Metro supplied background and educational information, staffed a composting helpline and conducted troubleshooting visits.

The experiment has been an unqualified success. Start-up problems were solved in the first few months — often by something as simple as turning the pile or adding more leaves — and most sites experienced participation rates of 30 to 60 percent. In some cases, more than 90 percent of residents have signed on and found their garbage has been cut by one-third.

Since the program's launch, the municipality has created a step-by-step model for setting up community composting, and some 200 other groups have expressed an interest in joining.

Mid-size, on-site windrow composting

Vegetable peelings, uneaten meals and other compostables from the kitchens of the Rideau Correctional & Treatment Centre and the livestock manure from its barns are being transformed into compost as part of provincial Green Workplace pilot project. Each day, about 315 kilograms of kitchen wastes are mixed with about three-times as much manure, ground up, and built into windrows on a 9 by 18 metre concrete pad. The windrows are turned daily for a period of six to eight weeks using a skid-steer loader.

Over the course of a year, 115 tonnes of wet kitchen waste and 350 tonnes of manure, shredded paper and cardboard will yield an estimated 182 tonnes of good quality compost for use on the facility's fields.

Although its environmental worth is indisputable, does the project make economic sense? On one side of the ledger: estimated operating costs of $2,815 a year. On the other: the Centre will save the $11,500 it used to pay in landfill tipping fees annually. The project's total capital costs of just under $35,000 will be recouped in three years.

metres of capacity) can handle the wet wastes of approximately 75 households, or up to 18 kilograms per day.

Typically, commercial systems are capable of handling 50 to 100 kilograms a day of a wider variety of food wastes. While capital costs range from $5,000 to $25,000, many of these units are still evolving from the prototype stage. As demand increases and designs continue to improve, prices are expected to drop. A number of commercial systems are currently being field tested at public and private institutions across Ontario, including: enclosed, mechanically turned, aerated units; two and three-bin systems; large-scale temperature-controlled vermicomposters; and rotating barrels.

S.5.2 The problem with high-rises

Vermicomposters and smaller, balcony composting bins are available for the high-rise apartment dweller who wants to handle his own wet wastes. However, space limitations and a relatively limited demand for compost in the average apartment may restrict the demand for individual apartment composters.

At most high-rise buildings food wastes will have to be collected for off-site composting. Retrofitting existing buildings with multi-stream collection chutes may be prohibitively expensive. The development of a sanitary, effective and convenient collection system is needed.

However, it will be easier to design new high-rises with flexible, innovative systems to collect wet wastes and other recyclables. Three-stream chute systems, to separately handle food wastes, recyclables and garbage, have been successfully tested. Alternatively, a control panel can be installed on a single chute to activate a turntable of collection bins in a building's basement. At the touch of a switch, residents could send their wet wastes to the appropriate container.

S.5.3 Making MOC work

Systems may be operated by the building owner, manager, superintendent or the residents themselves. Users must be trained to properly separate and add food wastes to the composter, as well as to avoid and, where necessary, troubleshoot problems. In many cases, a resident-run recycling or environment committee already exists at a prospective

MOC site and is well positioned to handle system management, as well as training and educational, duties. A so-called "buddy system" can be used to link tenants with neighbours who need help in separating or transporting their wet wastes. Some of the most avid composters are children who have learned about responsible waste management in school.

The success of multi-unit residential composting relies heavily on the commitment of residents and the energy of volunteers. On-going education is needed to keep enthusiasm and participation rates up; new tenants must also be initiated into the intricacies of composting. High-rises and buildings lacking green space pose special collection and on-site composting problems. However, as the first compost is spread over shared gardens, the rewards, both in terms of waste diversion and community pride, are great.

S.6.0 Central Composting

For a large number of wet waste generators, particularly in the IC&I sectors, access to a centralized composting system will be the only economically feasible diversion option to handle those wastes that can not be reduced or reused on-site. The other available options may be unsuitable for various reasons: the wastes may not be suitable for primary use, animal feed or rendering, or direct land application; the generator may not have the capacity or facilities to implement on-site diversion options; or other diversion options may be too expensive.

However, there is a dearth of central composting infrastructure in place in Ontario. If the diversion of wet wastes from landfill is to be maximized, it is vital that this infrastructure be developed.

Even if all the food and yard waste generated by households went into backyard composters, and smaller multi-unit buildings, schools, institutions and businesses set up mid-scale, on-site systems, there would still be a role for larger, central composting facilities in a wet waste diversion strategy. Centralized composting can:

(1) successfully process virtually the entire range of organic wastes, from wood wastes to sludges, including meats and other materials unsuitable for on-site composting;
(2) stabilize and sanitize (i.e., reduces the pathogens) in the material; and

The province's Green Communities Initiative assists local efforts to reduce waste and increase energy and water efficiency. For example, individual home audits, under the Green Home Assessment program, assess backyard composting, blue box use, household hazardous wastes handling and other environmentally sound practices. Seven communities are already involved (Guelph, Peterborough, Elora, Port Hope, Cornwall, Atikokan and Sarnia) with more expected to join. Each initiative is run by a committee which represents local government, business, environmental groups and individuals.

Two-Stream Source Separation
Pick-up requires two containers: one for wet wastes (food and yard wastes, soiled food wrappings, disposable diapers, etc.) and one for all other dry household waste materials. Recyclables are mixed with other dry wastes and may be recovered in a Material Recovery Facility (MRF).

Versus

Three-Stream Source Separation
Pick-up requires three containers: a "wet" container for food and yard wastes only, a "dry" container for recyclable materials (paper and cardboard, ferrous and nonferrous metals, glass, certain plastics, etc.), and a third container for non-compostable, non-recyclable materials (soiled food wraps, non-container glass, pottery, diapers, etc.).

(3) economically accommodate large quantities of incoming material.

Excellent sources of centrally-processed feedstocks include: those generators without adequate space for on-site facilities; those that have no on-site use for the compost produced; those who generate problematic waste streams or experience large seasonal fluctuations in waste generation totals; as well as those generators, both IC&I and residential, who are not willing and/or able to meet the management requirements of on-site composting

According to the Composting Council of Canada's "National Survey of Solid Waste Composting Operations in Canada," there are over 120 composting facilities operating or under development in Ontario. The majority of these are municipal leaf and yard waste composting sites. Two-thirds of Ontario's population live in communities served by leaf and yard waste composting programs of some kind. Leaf and yard wastes are either collected curbside or through public drop-off programs. Much of this work has taken place over the last two years. Approximately 75 percent of the now active sites are less than two years old.

Five combined composting and recycling facilities that would handle source separated municipal solid wastes are planned or in the pilot stage. Two of the proposals come from the private sector and three from municipalities. A list of composting facilities being planned or under development is contained in Appendix F.

S.6.1 The Fundamentals of Central Composting

Central composting includes the following elements:

- general separation and storage at generation point,
- collection and receiving (biowaste acceptability is judged),
- pre-processing (to remove contaminants and prepare the feedstock),
- composting,
- post-processing and curing (preparing product for market),
- storage and marketing, and
- on-going public education and promotion

Centralized composting facilities are required to have Part V approvals and Section 9 approvals under the Environmental Protection Act. Leaf and yard waste facilities, that comply with

the siting and operating provisions of the province's 3Rs regulations, will be exempt from obtaining a Certificate of Approval for waste disposal and for air emissions. Exempt leaf and yard waste composting facilities may not handle food wastes.

The collection and transportation methods are an integral part of any composting system. Source separation of the feedstock materials greatly reduces the levels of contaminants entering the system. Therefore, many communities are investigating two and three-stream collection systems. A variety of different curbside collection containers/systems are also being evaluated. The separation of food and yard wastes from other MSW sources may be done at the generation site, at the collection point (as it is being loaded into the collection vehicle), or at the processing site. Collection/separation systems include:

- tied bundles of yard wastes or open bushel baskets of leaves;
- paper bags (may be composted with wet wastes);
- plastic bags (less expensive than paper, but need to "debag" the compostables);
- reusable bags (need to be debagged at curb);
- degradable polymer bags (fully compostable bag is an innovative alternative to earlier "biodegradable" bags which only disintegrated into long-chain plastic polymers);
- specially labelled garbage cans (which can take advantage of the containers residents already have purchased; the municipality simply provides a distinctive, stick-on label); and
- roll-out carts (although more expensive, these large, highly visible containers may permit semi or fully-automated collection).

Preprocessing is essential to central composting efficiency. The production of good quality compost depends on the careful selection of feedstocks. Following collection and delivery, subsequent pre-processing functions may include: the opening and removal of bags (debagging); inspection and removal of plastic bags, cans and any other obvious foreign material; size reduction, magnetic separation and screening; and mixing and blending of feedstock components (i.e., food waste, leaf and yard waste, water, bulking agents and amendments, etc.). The screening and blending operations are designed to prepare the feedstock to its optimum physical and chemical structure (i.e., a C:N ratio of approximately 30:1 and a free air space of about 30 percent).

Collection systems:

(leaves only)
- vacuum truck
- catch basin cleaner
- front-end loader and a dump truck
- front-end loader and a rear packer

(food and/or yard wastes)
- bags and a rear/side loader
- (semi) automated cart collection

Level of Collection Service
- weekly
- biweekly
- monthly
- seasonal
- * combination

Processing functions are aimed at: preventing overheating while maintaining optimum temperature, supplying adequate oxygen, maintaining the nutrient balance, maintaining adequate moisture content, and providing sufficient residence time. Compost equipment is designed for: grinding (requiring tub grinders, shear shredders and conveyor equipment); turning (using front-end loaders or specially designed compost turners); and screening (using trommels).

Post-processing operations may involve: recovery of bulking agents, size reduction and separation, removal of inert components, and mixing, blending and/or bagging the compost product for market. Post-processing is designed, primarily, to produce marketable compost.

S.6.2 Central Composting Systems

Over the last fifty years, a number of innovative composting methods have been developed:

Aerated Static Pile

A static compost pile or windrow is constructed over a grid of perforated piping and a layer of bulking agent (such as wood chips) and/or finished compost. Fans are used to force (inject) or drawn (induct) air into the pile and support aerobic decomposition. The pile may be topped with another layer of finished compost to degrade odorous compounds and to provide insulation thereby maintaining a temperature adequate to destroy pathogens.

Static Pile

Alternating layers of chopped brown organic materials (high in carbon) and green organics (high in nitrogen) are built into a pile 1-2 m high. The action of the decomposers causes temperatures to rise in the centre of the pile, reaching an optimum of about 55°C in 4-7 days. At that point the pile may be turned (moving material from the outside to the centre), and extra water and nitrogen added, if necessary. The elevated temperature kills most weed seeds, pest larvae and pathogenic organisms.

In-Vessel Composting

In-vessel systems are either fully or partially enclosed. Improved mixing, automated process controls and monitoring systems are employed to maximize the composting environment (aeration, temperature and moisture conditions) and

speed the process. Aerobic decomposition takes place in containers of various types, including: rotating drum systems; horizontal channels either fully or partially enclosed; vertical (silo) configurations; or batch container systems.

Turned Windrow Composting

Windrows are long rows of organic material stacked into elongated piles with a triangular cross-section (approximately five metres across and two metres high). In turned windrow systems, the windrows are periodically torn down and reconstructed or turned mechanically (the outside layer of the original windrow becoming the interior of the rebuilt windrow) in order to aerate and mix the organic wastes, break up clumps, speed the decomposition process, and prevent odours. Turning the windrow assists the natural diffusion of oxygen into the pile to support aerobic decomposition. Windrow systems can be open (i.e., without enclosure), covered (i.e., under a roof), or completely enclosed in a structure.

S.6.3 Central Composting Case Study: The Hensall Compost Facility

Hensall, an agricultural community sitting just east of Lake Huron, is the "White Bean Capital of Canada" and, as such, generates some 4,500 tonnes of bean chaff, dust and other grain screening wastes each year. That's about 90 percent of all the wastes sent to the village's landfill.

With the landfill scheduled to fill up in less than five years, the local council began looking at composting alternatives. A windrow-style system, needing up to 18 months processing time, was deemed too slow. Instead, they opted for an in-vessel, positively-forced, aerated, continuous flow composting system.

The Hensall Compost Facility, designed and operated by LH Resource Management, was officially opened in October, 1992. The system consists of three channels, each about 32 metres-long, 4.6 metres-wide and 1.2 metres-deep. Each channel is capable of handling 11 cubic metres or eight tonnes of material per day.

The channel walls are formed of precast concrete and the base consists of crushed stone. Perforated PVC tubes run beneath the stones and are connected to a fan which pumps

air through the biomass. The amount of air going to each channel is controlled by dampers and a computer program.

Every 24 to 48 hours, fresh material is added to the end of each channel, while fresh compost is taken out the other end. Again, every one or two days (depending on the biological activity and porosity of the material), a mobile biomass processor moves up a channel, mixing, agitating and transporting material about 2.4 metres towards the unloading end. The retention time in the channel varies between 13 and 21 days. Once discharged, the compost must be cured for three to six months.

The facility is extensively monitored, from the raw material piles and blended feedstock, through processing and curing stages, to the finished compost. Drainage and leachate from the curing pads (which are recycled back into the system) are also checked regularly.

The plant produces 8 to 12 tonnes of compost a day which is sold to local landscapers, nurseries, top soil companies and farmers. In its first year of operation, approximately 4,000 tonnes of grain screening waste, corrugated cardboard and wood were converted into over 2,000 tonnes of rich, dark compost.

The province, community and private sector have combined to make the Hensall Compost Facility a success. Because it is considered an innovative, demonstration project, a provincial grant was received for a portion of the capital costs, with the remainder picked up by the three local seed cleaning and processing elevators. The Village donated the site and a tub grinder. When facility tipping fees and compost sales are factored in, the project is covering its operating, maintenance and amortized capital costs.

S.6.4 Central Composting Case Study: The Ontario Science Centre

Each week, approximately six tonnes of food waste are collected from seven local government facilities, including the Queen's Park cafeteria and the Toronto Jail, for treatment in the Ontario Science Centre's award-winning, in-vessel composter. In addition to a full range of food wastes (including plate scrapings, dairy products, meat, fish and bones), wood

chips, paper towelling and other amendment materials are fed into the double-walled, stainless steel chamber.

Temperatures in the vessel's "kill zone" are held in excess of 55°C for 4-6 days to eliminate pathogens. Feedstocks are blended to achieve the desired moisture and C:N levels; augers break the feedstock into smaller pieces. Three forced air fans maintain oxygen levels, with exhaust gases fed to a biofilter.

The unit, which began operation in June, 1993, is turning out a pathogen-free intermediate product in just 28 days. (The throughput could be doubled if the unit was switched to a 14-day cycle!) After stabilizing in windrows for three to four weeks, the finished compost is used for landscaping in Metro Toronto-area parks.

The system is operated by the staff and inmates of the Mimico Correctional Centre, under the direction of the unit's designer Wright Environmental Inc. The demonstration project, which won the Financial Post's annual Pollution Abatement Award, is part of the province's Green Workplace program. Green Workplace plans to apply for a Certificate of Approval which will allow it to sell the final compost.

S.6.5 Central Composting Case Study: The CORCAN Compost Centre

The Correctional Service of Canada (CSC) operates 12 facilities in the Greater Kingston Region which used to dump solid wastes in local landfills. Because these sites are expected to be filled by the year 2000, the Region and the CSC have been actively looking at waste diversion alternatives.

Based on the success of a pilot-scale, manure composting program, the CSC agency CORCAN was given the job of setting up a commercial composting centre. CORCAN helps offenders develop their employment skills by operating various business projects within corrections facilities. The local Canadian Forces Base, municipalities and MOEE are also participating in the project, sharing costs and contributing waste feedstocks.

Once the CORCAN Compost Centre begins operations in 1994, the region expects to be able to meet the province's 50 percent waste diversion target. In its initial, performance-

Leaf & yard wastes contain fewer contaminants than other sources of wet wastes. However, feedstocks may contain:

- packaging, cans and other litter
- pesticide residues
- pet feces and waste
- weed seeds and larvae
- trace street sweepings (which can include sand, silt, heavy metals, grease & oil)
- contaminated soils

Finished compost is relatively contaminant-free. Paper packaging biodegrades. Metal and plastic can be screened and removed. Most currently used herbicides and insecticides, while toxic, are readily degraded by micro-organisms. Weeds and pathogenic organisms are destroyed by the high temperatures of active composting.

testing phase, the facility can accept 12,000 tonnes of source separated organics, including: food wastes, old corrugated cardboard, paper and newsprint, agricultural products, sawdust and clean wood, and dewatered, digested sewage sludge. As feedstocks increase, the capacity is designed to grow to 50,000 tonnes per year.

The compost produced will be sold to the stakeholders in the CORCAN project for use in public parks, gardens, football fields and golf courses. Surplus stock will be sold to commercial landscapers, garden centres and retail outlets. Future expansion may include a retail bagging facility to increase marketing opportunities.

S.7.0 Leaf and Yard Waste Composting

Of all the composting alternatives, the recycling of yard and leaf wastes (grass clippings, leaves, conifer needles, bush trimmings and prunings, bark and other woody matter, soil, etc.) would seem to be the least controversial. Leaves are rich sources of carbon, minerals and fibre, and are generated seasonally in predictable amounts. They are relatively easy to collect and compost on-site (in backyard or mid-scale systems) or off-site (at central compost facilities). Shredded leaves and grass clippings can be used as mulch. And certain leaf and yard wastes, particularly leaves, may also be applied to agricultural lands.

Municipalities offering leaf and yard waste composting services must devise an effective collection program (both bulk bag pick-up and vacuum shredding trucks have proven themselves), and establish a central composting facility. While bagged wastes may require debagging and introduce contaminants (in the form of shreds of plastic), bulk pick-up requires the purchase of specialized collection equipment. Depot or drop-off programs may be inconvenient or impractical for the elderly or those who lack private transport.

Depending on the space and resources available, the available composting options range from simple static pile systems to more complex, mechanical systems that incorporate forced aeration and automated turning and water capabilities. While the latter systems are more costly, they offer reduced retention times and better process control. The most commonly used method is the turned windrow approach.

S.7.1 The success of leaf & yard waste programs

The amounts of yard and leaf waste available for off-site central composting depend on a number of factors, including:

- the type of municipal collection service offered (curbside pick-up seems to encourage greater participation than drop-off programs);
- the level of service provided to the residential and IC&I sectors;
- the container and collection system chosen (the use of paper or plastic bags, garbage can-type containers or bulk pick-up options each dictate their own municipal handling and equipment requirements);
- the type and range of plant types favoured by the community (in turn, influenced by the length of the growing season, precipitation and temperature patterns, altitude, latitude, etc.);
- the time of year (with partially decayed material dominating in spring pick-ups, while grass and leaves exceed all other materials in the summer and fall);
- the residential patterns of the community (such as average lot size, the age of the community, the proportion of single-family dwellings, etc.); and
- the amount of park land and other green space.

Case study results vary widely: generation rates range from 4 to 34 kilograms per household per year across Ontario. Similarly, the ratio of leaves and brush to grass and other green vegetative material is site-specific: nationally, relative proportions of "leaves to grass" average 1:2, but again vary dramatically. Extrapolating estimates from one community to another is speculative at best.

The City of Waterloo ...

runs two central composting facilities for handling some of the leaves brush and grass clipping generated by its 124,000 households. Some 4,500 tonnes of bagged leaf and yard wastes are composted each year. Simple windrows are built over eight acres of granular pads with a crushed limestone cover. Turning is done weekly using a front-end loader. Capital costs are estimated at $22.20 a tonne and annual operating expenses at $31.00 per tonne. The finished compost is used in city parks or given away free to the public. Some communities have found that the sale of compost can greatly reduce overall costs.

S.8.0 The Principles of Good Waste Management

S.8.1 Pest Control

Perhaps alarmed by stories in the media, a number of people have expressed the concern that composters, both large and small scale, may attract raccoons, rats, seagulls and other urban scavengers. These concerns are largely unfounded. Metropolitan Toronto has sold more than 100,000 backyard composters to homeowners. While it has received some 10,000 composting questions over its helpline, only 30 of these had to do with pest-related problems. And of those 30, the majority were caused by poor maintenance. Central composting facilities experience the same low incidence of pest-related problems.

A properly designed and maintained backyard or mid-scale compost system is virtually pest-proof. For example:

- Flies are only a problem when food wastes are left uncovered; spread a one-inch layer of leaves or soil, or bury food into the centre of the pile.
- Add only recommended wastes.
- Harvest the finished compost at least once a year.

A heavy hinged lid, held securely in place, should keep out raccoons, dogs and other large pests. To make a bin rat-resistant, construct it using sturdy half-inch wire mesh. And then add a layer of thinner quarter-inch mesh to keep out the mice. Or use a 16 to 20 gauge hardware cloth. A bin can also be placed on patio stones or hard-packed limestone to deter burrowing from below. However, in the event a nest of mice makes a composter their home, don't panic; they usually don't cause any problems.

S.8.2 Odour Control

Odours are only a problem when a pile has not been turned regularly, or too much of the wrong wet wastes have been added. In the case of backyard and mid-scale composting, remedial measures (such as adding some dry leaves and soil or removing the offending material) usually solve the problem in a few hours or, at most, days. To eliminate smells in BYC units:

- Do not add large, unchopped items to the pile.
- Make sure each layer of grass or food scraps is no more than 4-6 inches thick. Try to add equal amounts of green (nitrogen-rich) and brown (carbon-rich dead leaves) materials to the pile.
- Keep the pile as damp as a well-wrung sponge (too much water may create a rotten egg smell).
- Never add meat, bones, dairy products, fats or oils.
- Aerate the pile by turning it with a shovel or specialized turning tool.

Odour control at central composting facilities again relies on preventive maintenance, proper aeration, good housekeeping, vigilance and the prompt response to any emerging problems. However, a review by the composting journal BioCycle found that 100 percent odour control is almost impossible to achieve. Scrubbers or other air pollution control systems may also be

needed to remove residual ammonia and/or hydrogen sulphide from exhaust gases.

Odour control strategies range from the simple to the complex. At the high-tech end of the scale, they can involve complex, three-stage scrubbing equipment (cooling of exhaust gases is followed by acid stripping, to remove most of the ammonia and other nitrogen amines, and a hypochlorite wash, to catch most of the hydrogen sulphides). Biofilters are an alternative to scrubbing and incineration. A biofilter is an organic matrix (usually consisting of finished compost, bark chips, peat moss and other organic materials) through which off-gasses are passed. Micro-organisms in the biofilter capture and degrade odorous compounds.

The on-site handling and accumulation of wet waste feedstocks can also give rise to odour problems. For example, bagged grass clippings which are left to sit in the sun for a few days while waiting for pickup begin to decompose anaerobically. When they are sliced open curbside the smell can be unpleasant. However, when thousands of bags are brought to a central facility, the smell can be overpowering and cause complaints by neighbours. Most storage problems can be minimized by adding feedstock to the compost windrows (or other composting configuration) as quickly as possible.

S.8.3 Disease Control

A properly planned, maintained and managed compost facility, no matter the size, is not a threat to the health of either the operators or the people who live next door. But certain precautions must be taken. While a pile of leaves or a bucket of kitchen scraps looks innocuous enough, composting feedstocks can harbour some possible pathogens and allergens.

For example, enteric disease agents (which cause intestinal infections) may be found in disposable diapers, pet waste and infected food products (materials which are not suitable for backyard or mid-scale composting, but which may be diverted to central compost facilities). Fortunately, a properly managed composting facility effectively destroys most or all of these micro-organisms.

The provincial compost guidelines specify temperature and turning requirements for composting processes to ensure that the entire composting mass is subject to temperatures which

significantly reduce pathogenic organisms (bacteria, protozoa, viruses, helminths and other parasites).

However, the potential health risk does not disappear when the offending micro-organisms are dead. Noxious endotoxins, which may cause fever, diarrhea and other health problems if sensitive facility staff inhale high levels, are released during the decomposition of dead cells of some species of bacteria. Occupational health and safety procedures are being developed to minimize this in-plant health risk.

Finally, of the hundreds of fungi that may thrive in hot compost, a handful produce tiny spores that may cause asthma-like reactions, bronchitis and other respiratory problems. The species *Aspergillus fumigatus* is of concern in composting. *A. fumigatus* is a species that grows in dead organic matter; as such, it is found virtually everywhere, from forests to fields to basements and washrooms.

Again, most people are immune to these fungi and molds; only individuals suffering from immune suppression conditions are at risk. While it's not possible to prevent fungal growth, potential health problems can be minimized by implementing dust control programs designed to prevent spores from becoming airborne. And adequate buffer zones will prevent the spread of spores to the surrounding community.

What's the bottom line? A number of occupational health studies in Canada and the U.S. have shown that although levels of *A. fumigatus* are higher at composting sites, there has never been a reported case of serious infection associated with the facilities, either in the workers or the neighbouring public. A partial listing of the literature on the health risks of central composting is presented in Appendix H.

S.9.0 Compost Marketing Concerns

Compost from MSW wet wastes is increasingly regarded as an environmentally-valuable commodity. It should also be seen as economically-valuable; compost is able to compete, on the basis of price and performance, with traditional, commercially-available soil conditioners, such as composted manures, peat moss, and bark chips.

In order to improve the viability of central composting, the marketplace for compost products must be expanded. In the

near-term, the most promising targets will include horticulturists (such as nurseries and greenhouse growers which require potting soil), landscapers and municipal users (which may use compost as a pesticide-free alternative for low-maintenance turf care), and provincial agencies (which adopt procurement policies giving preference to recycled products).

Large quantities of compost could also be incorporated into the soil prior to sodding or seeding during park construction, roadside re-vegetation, gravel pit reclamation and other recovery projects. The development of agricultural markets, while offering a huge potential, is still years away. Because of the low density/high bulk of the product, transportation costs remain a limiting factor and major markets will likely remain close to major sources of supply.

Over the long-term, the agriculture industry is the largest potential market for compost. To maximize the potential for this market: compost must be available at the appropriate time of year; supplies must be available locally and marketed at a reasonable cost; compost must be consistent in composition, meet nutrient content standards and not contain potentially toxic levels of contaminants; and, otherwise, be acceptable to farmers.

In the short-term, the other market sectors will be more important compost consumers. With some municipally-run composting programs giving away compost free-of-charge to residents, private sector operators say market stability for bagged compost products may be at risk. As well, the market impact of significantly increasing the supply of compost is unknown. Other factors affecting demand include:

- the lack of uniform specifications for compost (including such product quality parameters as organic matter content, particle size distribution, nutrient content, potentially toxic and nontoxic contaminants, weed seed concentration, seed germination and elongation, soluble salts, C:N ratio and pH);
- the availability of compost compared to competing and complementary products in the marketplace (such as fill dirt, top soils, riverbottom silt, potting soils, custom soil mixes, bark mulch and wood chips, manure, peat moss, mushroom compost, perlite and vermiculite); and

Potential markets for compost include:

- landscapers
- nurseries and greenhouses
- orchards and vineyards
- soil manufacturers and retailers
- conservation authorities
- parks and recreation departments
- municipalities
- provincial agencies (such as highway maintenance)
- quarry and other land reclamation projects
- Christmas tree farms and other silviculturists
- golf courses
- turf and sod farms
- homeowners and gardeners
- field crop agriculture

End-market compost quality issues include:

- nitrogen, phosphorus, potassium (NPK),
- salinity,
- pH,
- moisture content,
- particle size,
- non-biodegradable particulate matter,
- micro-nutrients

- distance to markets (proximity to composting facilities increases product recognition and cuts shipping costs).

Several studies have shown that the markets for compost will be there, as long as product quality is consistent. Compost quality is related to nutrient (expressed as N:P:K) content, salts, trace elements, organic chemicals, and pesticide residues, as well as colour, odour, visible contaminants and other physical attributes. For marketing to be successful, compost specifications have to meet the requirements of consumers; buyers want to know what they are getting and may want to see the compost content details on a label.

Compost testing will enable growers to compensate for compost quality variations and provide the proper balance of nutrients and other elements to their plants. However, operators will still have to be flexible enough to turn out a product for which the end-user will pay. Composts with specific properties may be required to fill niche markets.

S.9.1 Provincial Compost Quality Guidelines

To successfully market a compost product, the material must satisfy two sets of quality criteria: criteria related to environmental protection and criteria related to the requirements of the intended end use. Provincial environmental protection criteria are described in the "Interim Guidelines for the Production and Use of Aerobic Compost in Ontario, November, 1991" which are administered by the MOEE in order to protect human health and the environment while permitting compost production and use.

The guidelines are designed to assist facility proponents, MOEE staff and the staff of other agencies in the selection and/or approval of appropriate aerobic composting methods and the production of quality compost based on good operating practices, compost characteristics, and current MOEE legislation. The Interim Guidelines are subject to periodic revision as new information becomes available.

Finished compost which is to be transported off-site must be tested and meet the Guidelines' quality criteria if it is to be used on an unrestricted basis. Compost which does not meet the criteria is considered a "Processed Organic Waste" under

Ontario Regulation 347 and may be applied to an approved "Organic Soil Conditioning Site" or disposed of at a properly licensed facility.

Criteria included in the guideline:

- trace metals content,
- organic chemical content,
- non-biodegradable particulate matter, and
- stability.

Pathogens are controlled through process requirements.

Compost produced from on-site operations, except backyard composters, must be tested in accordance with the provincial guideline. In addition, site operators must comply with other provincial environmental protections standards, such as those dealing with groundwater protection and air emissions.

S.9.2 National Compost Quality Guidelines

Agriculture Canada regulates the use of compost and sludge in agriculture and horticulture under the federal Fertilizers Act, the Regulations Respecting the Regulation and Control of Agricultural Fertilizers, and trade memoranda under those regulations.

The Fertilizers Act applies to fertilizers and supplements sold in Canada (i.e., there must be a bill of sale). A product is considered a fertilizer under the Act if it is represented, manufactured or sold for use as a source of plant nutrients, that is as a source of NPK. Similarly, a supplement is intended to improve the physical condition of soils or to aid plant growth or crop yields.

The relevant regulations under the Fertilizers Act specify the requirements for registration, guaranteed analysis, and labelling of fertilizers and supplements. Composts and processed sewage sludges are exempt from the registration requirements. However, such supplements must comply with the labelling and analysis provisions (covering organic matter, moisture content and, in some cases, the number and type of active micro-organisms), regardless of whether they are sold in bulk or bagged. Finally, Trade Memorandum T-4-93 limits the concentrations of nine metals in processed sewage and by-products, and composts.

National standards for compost quality are currently being developed by the Canadian Council of Ministers of the Environment (CCME), with the assistance of the Bureau de normalisation du Québec (BNQ), Agriculture Canada, Environment Canada and the Association québécoise des industriels du compostage. The BNQ have been accredited by the Standards Council of Canada to write industry standards on compost.

In addition, the results of the CCME process may be used to produce additional AgCan trade memoranda covering compost quality and safety criteria, including: trace metals, inert contaminants, organic contaminants, pathogens and maturity. (The BNQ standard will include other concerns, such as electrical conductivity, pH and organic matter content.) The CCME standards are also designed to be used to harmonize the various provincial and territorial controls covering the disposal and beneficial reuse or wastes.

S.10.0 Anaerobic Digestion

While the bulk of this report addresses the contribution aerobic composting systems can make in diverting wet wastes from disposal, anaerobic composting processes are also under active development. In Europe, anaerobic systems are emerging as a viable alternative (especially for high-moisture wet wastes). In future, such systems could be used to convert wet wastes into compost as well as produce high-Btu methane gas.

Methane is a colourless, flammable gas (CH_4), commonly called marsh gas, produced when organic material biodegrades under anaerobic conditions (i.e., in the absence of oxygen). Methane may be collected at landfills and anaerobic composting facilities, burned for heat or to generate electricity, or used to produce methanol. Methane is the main component of natural gas.

The start-up and management costs of anaerobic treatment systems are relatively high.

However, due to the shorter retention time of wastes in the digester vessel and the elimination of the need for bulking agents, they may compete favourably with aerobic composting when the capital costs per tonne of capacity are considered.

Depending on the feedstock, pretreatment may involve sorting (to remove other recyclables), shredding or particle size reduction. Anaerobic treatment takes place in a completely enclosed system that minimizes potential odour problems. In order to support the microorganisms required for decomposition, the environment of the digester vessel (temperature, moisture content, the level of micro and macro-nutrients, and oxygen) must be carefully regulated. The gases generated during decomposition are continuously drawn off.

The retention times for MSW ranges from 9 to 21 days, depending on the technology used, the waste composition and the internal and external process conditions. Some newer anaerobic technologies operate at higher temperatures and degrade material at a faster rate. Seasonal variations in the composition of municipal wet wastes (dominated by green garden wastes in the summer) may be problematic.

The end-products are a very moist, unstable organic mass and a gas containing methane (55-65%), carbon dioxide (34-44%), hydrogen sulphide, nitrogen and water. The liquid supernatant can be recirculated into the system. The raw organic mass is transferred to windrows until it has stabilized and decomposed, under aerobic conditions, to produce a compost-like product. The methane generated is captured and can either be burned on-site (to regulate temperatures in the digester vessels) or converted to methanol.

Methane production plants have been built in association with sewage treatment plants, industrial wastewater facilities and agricultural operations. Demonstration or commercial scale plants are currently operating in Florida, Finland, Germany, Denmark, Belgium and France. No biogas facilities using MSW as a feedstock are currently in operation in Canada.

Currently, there are several problems limiting the biogasification of MSW:

- the process is relatively inflexible to changes in feedstock;
- process efficiency depends on maintaining optimum conditions for microorganisms (anaerobic conditions are more difficult to control as reactor size increases);
- temperature control in colder climates may be problematic; and
- beyond its on-site utilization as a boiler fuel, marketing small quantities of methane may not be economic.

S.10.1 Methanol Production

Methanol (CH_3OH), also called methyl alcohol or wood alcohol, is a liquid usually derived by either a high-pressure catalytic process or the oxidation of natural gas. Several technologies have been developed to process methanol directly from biomass sources, including agricultural and other organic wastes; methanol can also be produced from the methane generated during anaerobic composting. However to date,

Other promising recycling technologies under development include:

- thermophilic digestion for protein recovery
- dehydration systems with protein recovery
- steam explosion techniques

such biomass conversion processes have proven to be far more complex (and more expensive) than the production of methanol from natural gas.

S.11.0 Other Diversion Initiatives

S.11.1 Ethanol Production

Ethanol (C_2H_5OH), also known as ethyl or grain alcohol, is a colourless, volatile, flammable liquid that is usually produced from ethylene (a derivative of the oil refining process). Production of ethanol from biomass (for example, grains, waste paper or MSW) may provide an alternative energy resource that extends Canada's non-renewable petroleum reserves. Biofuels may be blended, in relatively small amounts, with gasoline to produce environmentally-friendlier oxygenated fuels and fuel additives, and can also be used as fuel in boilers or furnaces.

A three-step fermentation/distillation process may be used to convert agricultural wastes or other sources of biomass into ethanol. Grinding, shredding and other pretreatment is followed by enzymatic hydrolysis, during which enzymes break down complex carbohydrates into a slurry of sugars and starches. Next the slurry undergoes fermentation to convert the sugars to ethanol. Finally, that ethanol is captured and concentrated through distillation. In addition, protein-rich animal feed and other valuable by-products may be recovered during ethanol production.

The technology for converting grain-based agricultural products into ethanol is well advanced, and pilot projects have shown that paper fibre and wood wastes might make an acceptable good biofuel feedstock. However, no one in Ontario is currently looking at converting MSW to biofuels. The process is very sensitive to variations in the quality of the feedstocks (pesticides and other contaminants in MSW may kill the microorganisms that are responsible for fermentation). In addition, variability in the MSW stream may adversely affect the efficiency of the process and the quality of end product (particularly as animal feed).

S.11.2 Animal Feed Production

A number of new technologies are emerging to produce animal feeds from food wastes. Basically, the protein is extracted

from dehydrated food wastes and blended with other material to form and animal feed

In simple dehydration or drying systems, the protein must be used relatively quickly before spoilage. The advantage of such systems is that a wide variety of feedstocks may be used. The more advanced thermophilic digestion and steam explosion systems stabilize the protein in the form of a dry powder which has a longer shelf life. The disadvantage is that these are more capital-intensive systems and the processing cost per tonne may be high. However, given a strong market for the animal feed products produced, the technologies may still be considered economically viable.

A number of commercial-scale thermophilic digestion systems are in operation or under development, including facilities in up-state New York, Vancouver and Brampton, Ontario. Traditionally, they have been used to treat the dedicated wastes from one generating source, although with the proper collection and screening mechanisms in place biological digestion systems could handle smaller quantities of wet wastes from a number of sources. Steam explosion systems are still at the bench or pilot-scale.

S.12.0 What is Primary Use?

"Primary Use," according to STEWWR's working definition, involves the redistribution of surplus food, in its safe, nutritious and original form, to others who can use it. Primary use programs are not designed to feed "waste" food to the poor, but rather, to prevent edible, wholesome food supplies from becoming "waste" in the first place. (However, "food drives" are not considered a primary use activity, as they do not contribute to waste diversion.)

In practical terms, the recipients are food banks and other social assistance organizations which serve needy individuals. There are two categories of groups served by the primary use system: "emergency" users of food, such as food banks; and "supplemental" users, such as community service shelters, residences, missions, etc., which use the food provided as a supplement to that normally provided by social agencies. In turn, each of these operate grocery programs and meal programs. There is also some cooperative networking; when food banks receive large donations of perishables or snack foods, these may be shared with supplemental programs.

The Second Harvest organization redistributes food, with its focus on perishable prepared foods, directly to social agencies located, primarily, in the central core of Metropolitan Toronto. The organization enjoys strong support from both the local small business community (which make frequent donations) and major food companies (which donate larger quantities of food, although less frequently). Second Harvest's primary sources of donations are, in no particular order: bakeries, restaurants, convention centres, hotels and grocers. In 1993, Second Harvest managed 506 tonnes of prepared foods, which it passed on to women's and youth shelters, missions and drop-in centres for street people.

Regulations & Guidelines Protecting Food Quality

Health & Welfare Canada

The federal Food and Drugs Act, administered by Health and Welfare Canada, specifies labelling requirements for prepackaged foods.

Ontario Ministry of Agriculture, Food & Rural Affairs (OMAFRA)

OMAFRA's Fruit and Vegetable Grades Regulation, under the Farm Products Grades and Sales Act, sets quality standards for the fruits and vegetables sold in Ontario. Those that do not meet the standard cannot be sold or shipped (and are usually dumped or land applied). The legislation does not apply to unharvested produce and, therefore, does not regulate "pick-your-own" operations or gleaning programs.

Although OMAFRA administers several other acts related to the production of food, it does not oversee the food safety of processed foods. The Milk Act, Meat Inspection Act, Livestock and Livestock Products Act, and the Edible Oils Products Act regulate the production of these commodities but not their sale.

There will be a need for primary use programs as long as: (i) there exists a supply of surplus foods suitable for human consumption, and (ii) there is a need for food banks and/or other non-profit social assistance organizations. There is, therefore, an ongoing opportunity to increase the amount of food available to the needy and, at the same time, divert useful resources from disposal.

Some stakeholders believe that while the need for food banks will not disappear, their focus may change. In the future, food banks may respond less to emergency requirements for food by those requiring assistance, and provide more of a "gleaning" function (offering supplemental support for other social agencies such as missions and residences, as well as providing a ready outlet for individuals and companies to donate surplus foods).

S.12.1 The Administration of Primary Use Operations

The distribution of food donations from large corporate sources is coordinated at both federal and provincial/local levels. The Canadian Association of Food Banks (CAFB) undertakes to achieve an equitable distribution across Canada of food products which are donated in large quantities. (The CAFB does not operate its own warehouse facilities; when it learns of a sizable pending donation, it prepares shipping orders to redistribute the food to its clients across the country.) Clients of the CAFB include provincial food bank organizations such as the Daily Bread Food Bank in Toronto.

To achieve cross-country distribution, the CAFB must also maintain relationships with transportation companies who provide their services voluntarily. Some food companies provide transportation; in other cases, local volunteers provide collection services. Few donations are lost because of lack of transport.

At the provincial level, food bank distribution centres manage donations received from the CAFB, local corporate sources and public food drives. For example, the Ottawa Food Bank fills food orders received from their member agencies (hamper programs, residences, missions, etc.). In addition, many grocery distributors (including food retailers) contribute food directly to hospices, local food banks and soup kitchens.

Since November, 1993, a provincial coordinator, operating out of the Waterloo Region on behalf of the Ontario Association of Food Banks, has organized the movement of surpluses to food banks around the province. Erb Transport donates shipping services for fresh and frozen perishables to all destinations across the province which will take at least a pallet of food. In addition, there are a number of routes for the delivery of non-perishables. Smaller food banks can also come to larger outlets to pick up loads. However, service to northern food banks is poorer. Further experience with this system will be necessary to identify any deficiencies.

The primary use system employs few people on a permanent or semi-permanent basis and relies heavily on volunteers to handle, sort and repackage donated food.

S.12.2 Sources of Surplus Foodstuffs

The Ontario Food Bank Association estimates that one-sixth of all food wastes that are being dumped in landfills have never been taken out of their packaging (culls, processing wastes, peelings, trimmings and table scraps make up the remainder). Food industry estimates suggest that 18 to 35 percent of food is discarded as unsalable at some point during the processing, production and sales cycle. However, the quantity of food available for donation to food banks and other primary users is significantly lower when unsuitable supplies are eliminated on safety and nutrition grounds.

Many grocery manufacturers, distributors and retailers are concerned about possible liability associated with their donations of comestibles (in the event that someone gets sick and decides to sue the supplier of the donated food). The passage of what is sometimes called "Good Faith Donation Legislation" may encourage those who are not presently contributing to do so.

Summary data on the quantities of foodstuffs diverted from disposal through primary use efforts does not exist. The CAFB has estimated that 45,000 tonnes of food are distributed through the primary use system nationally. Proportionally, Ontario would comprise approximately 20 to 30 percent of this total, some 9,000 to 15,000 tonnes. This total includes food from both corporate sources and public food drives, with corporations responsible for approximately 45 percent of the donations. Primary use efforts are difficult to quantify as the

Ontario Ministry of Health

The Ontario Ministry of Health's Food Premise Regulations, under the Health Protection and Promotion Act, apply to premises where prepared and packaged foodstuffs are sold or distributed. They establish criteria for food (such as meat, dairy and other products) which could support the growth of pathogenic organisms, and set storage and handling requirements. The regulations apply to food banks.

Canadian Restaurant and Foodservices Association (CRFA)

CFRA publishes the "Sanitation Code for Canada's Foodservice Industry" to provide guidance on microbiology and food-borne illness, as well as proper preparation, handling, distribution and storage. The CRFA encompasses eleven sectors including: licensed and unlicensed restaurants, accommodation foodservice, take-out and delivery, institutional foodservice, caterers, pubs/taverns and lounges, vending and other food retailers such as snack bars, and other retail stores.

Canadian Council of Grocery Distributors

The CCGD publishes the MUST MANUAL II, which: describes the characteristics of micro-organisms, symptoms and prevention of food-borne illnesses; prescribes procedures for housekeeping, sanitation and pest control for food distributors and retailers; and provides guidelines for food protection.

The Canadian Association of Food Banks (CAFB)

Food Safety Guidelines for Food Banks have been adopted by the CAFB and recommended to all food banks. The guidelines were first developed in Saskatchewan and accepted by the Saskatchewan Department of Health in 1992. The guidelines provide a series of general principles and recommended practices to safely handle all food received by food banks.

types and quantities of food diverted vary on a daily basis.

The primary types of food products (Fresh Produce, Prepackaged or Bulk Processed Foods, and Prepared Foods) potentially available for redistribution are discussed below.

Sources of Surplus Foodstuffs

Source	Food Type			
	Fresh Produce	Bulk /Processed	Packaged /Processed	Prepared Foods
Agriculture	■			
Processors	■	■		
Product Mftrs.		■	■	
Product Dist.			■	
Food Service				■

S.12.3 Fresh Produce

Fresh fruits and vegetables become available for redistribution primarily through gleaning, which involves recovering produce which has been dropped by harvest machinery or otherwise missed during harvesting, and in the form of culls, which are fruits and vegetables discarded during the initial grading because they do not meet provincial standards for size, shape, colour, absence of blemishes, etc..

Gleaning is not a widespread practice, although it has been employed by several primary use agencies. Gleaning is a very labour-intensive activity and its success often depends on the availability of sufficient volunteer labour. In addition, some farmers are reluctant to allow gleaners access to their fields or orchards.

Although the food processing industry does not maintain statistics on cull tonnages, a large portion of culled fruits and vegetables are currently being directed to reprocessing, animal feed and land application. Factors limiting the primary use of culls include the difficulty in providing collection, handling and distribution infrastructure capable of managing large quantities of materials in a short time and with little advance warning. Provincial waste management legislation also prohib-

its the transportation or shipment of culled produce, although this restriction may not be strictly enforced.

S.12.4 Prepackaged or Bulk Processed Foods

The grocery products distribution system includes "reclamation centres" to manage packaged food not sold through the retail distribution system. These centres prepare materials for disposal or secondary usage including primary use options (although such centres usually do not handle much food that would be suitable for primary use organizations), reprocessing, composting and animal feeding.

Most primary use donations are made by manufacturers and distributors (who by-pass the reclamation centres) and go directly to the food banks, soup kitchens, local hospices, etc.. In addition, these sources also send food waste to compost facilities or divert it as waste derived animal feed.

The following kinds of prepackaged or bulk processed foods (in order of decreasing quantities), originally intended for sale, may be donated by wholesale and retail grocery product manufacturers or distributors:

- "stale-dated" foods which are approaching their "best before" date;
- "off-spec" foods which fail quality control criteria in a non-critical area such as colour, shape, granulation or packaging;
- product returns or process "overruns" produced in excess of the quantity which can reasonably be expected to be sold; and
- incorrectly labelled products (for example, a breakfast cereal packaged in a box with the wrong brand name).

S.12.5 Prepared Foods

Prepared foods are those lunches, dinners, deserts and other meals intended for immediate consumption. The most usual sources of surplus prepared foods are caterers, restaurants and hotels which service large groups of people (at banquets, weddings, conferences, etc.) and often prepare extra, unconsumed meals. The success of redistributing prepared foods depends upon speedy collection and delivery to user agencies to support timely consumption.

Proposed amendments to Nova Scotia's Volunteer Services Act ...

... would redefine the term "volunteer" to include "an individual, corporation or organization that donates or distributes, for free, food or sundries to those in need."

"A volunteer is not liable for damages incurred as a result of injury, illness, disease or death resulting from the consumption of food or the use of sundries by a person in need unless it is established that:

(a) the injury, illness, disease or death was caused by gross negligence or the willful misconduct of the volunteer; or

(b) the volunteer knew or ought reasonably to have to known that the food or sundries were contaminated or otherwise unfit for human consumption or use at the time of donation or distribution, respectively."

– *Bill 206, An Act to Amend Chapter 497 of the Revised Statutes, 1989, the Volunteer Services Act.*

S.12.6 Assessing Food Quality

Whether a particular batch of food is suitable for redistribution is primarily a question of food safety and nutrition. Determining whether food can be safely redistributed requires careful consideration of the following factors:

- the type of food: certain types of foods, especially those containing meats or dairy products, are susceptible to contamination by pathogenic organisms;
- the condition of the food at time of availability: spoiled products or those susceptible to rapidly deteriorating quality are, in most cases, unsuitable;
- the capabilities of the redistribution system to maintain food quality: foods which require careful temperature control (such as continued heating or cooling) are not suitable for redistribution if these facilities are not available within the system. Similarly, bulk products are suitable for redistribution only if the material can be packaged safely.

S.12.7 The role of "Good Faith Donation Legislation"

In the U.S. and other jurisdictions, so-called "Good Samaritan" laws have been passed to protect those who offer good faith assistance from civil suits or other liability arising from their actions. The initial intent was to protect doctors, who offered free emergency assistance, from malpractice suits. The Good Samaritan concept as been expanded in a number of jurisdictions to limit the liability of donors of food products from suits arising from illness, disease or other health impacts experienced by the consumer.

Grocery product distributors and manufacturers have identified the need for such protections as a major determinant in maintaining and possibly increasing food donations from their members. There is concern that a brand owner could be named as the responsible party should unfit food end up in the hands of the public (even though the responsibility for maintaining food quality had passed to a food bank or other primary use organization). There has not been a successful lawsuit of this type in Ontario; however, the damage such a lawsuit could pose to a product's image may deter donations by some brandowners.

Good Samaritan legislation does not offer complete immunity; protection would be contingent upon the donor demonstrating

a reasonable standard of care. For example, donors would be required to inspect food to determine whether its is fit for consumption at the time of donation. Those guilty of gross negligence, recklessness or intentional misconduct would still be liable.

The Good Samaritan concept may be embodied in "Good Faith Donation Legislation" (GFDL). GFDL provisions were incorporated into Quebec's new "Civil Code" in December, 1991, and the government's Bill 206 was introduced in 1992 to amend Nova Scotia's "Volunteer Services Act" to achieve similar results (see the sidebar, page S-42). In addition, New Brunswick passed a "Charitable Donation of Food Act" on May 20th, 1992. South of the border, all 50 states and the District of Columbia have enacted some form of Good Samaritan legislation. Ontario currently has no such legislation in place.

Existing provincial legislation governing food safety could be amended to include GFDL provisions. Alternatively, discrete GFDL legislation could adopt, by reference, the existing food safety standards and handling practices for food products that are donated. Most participants in the Primary Use SubGroup of STEWWR favour the latter alternative; the only unresolved point was the determination of the appropriate host Ministry (i.e., Environment and Energy, Community and Social Services, Health, the Attorney General, etc.).

Reuse agencies dealing in goods other than foodstuffs, such as clothing, furniture, appliances and so on, have recommended that the scope of GFDL legislation be expanded to include a wider variety of products. For example, donations of shipping and handling services could be included under a "goods and services" section of a GFDL legislative package.

Despite almost universal support from grocery manufacturers and distributors, not everyone believes that the implementation of GFDL legislation would increase donations significantly. While recognizing the validity of GFDL protections in the litigious U.S., some critics point out that no legal suits launched against Good Samaritans in Ontario have been successful. (There is also some question whether special legislation is required given that common law already supports certain limits on donor liability.)

However, some industry representatives say a suit need not be successful for it to impact negatively on primary use pro-

grams; if a lawsuit, with its attendant publicity, was brought against a corporate donor, donations could "dry up overnight." Of additional concern, the food which had been directed to beneficial use (through primary use activities) would then require management through other means.

APPENDICES

APPENDIX A
ACRONYMS

AB	Animal Bedding
AF	Animal Feed
ALOHA	Association of Local Official Health Agencies
AMO	Association of Municipalities of Ontario
AMRC	Association of Municipal Recycling Coordinators
BOMA	Building Owners and Managers Association
BYC	Backyard Composting
CAC	Consumer Association of Canada
CAFB	Canadian Association of Food Banks
CARI	Canadian Association of Recycling Industries
CCC	Composting Council of Canada
CCGD	Canadian Council of Grocery Distributors
CFIG	Canadian Federation of Independent Grocers
CofA	Certificate of Approval
CRFA	Canadian Restaurant and Foodservice Association
CWME	Canadian Waste Materials Exchange
DLA	Direct Land Application
EAA	Environmental Assessment Act
ECP	Environmental Choice Program
EFW	Energy From Waste
EPA	Environmental Protection Act
GIPPER	Governments Incorporating Procurement Policies to Eliminate Refuse
GPMC	Grocery Products Manufacturers of Canada
GPP	Government Procurement Policy
IC&I	Industrial, Commercial and Institutional
ISA	International Society of Arboriculturists
K	Potassium
LCA	Life Cycle Analysis
LO	Landscape Ontario
MBS	Management Board Secretariat (formerly MGS)
MCSS	Ministry of Community and Social Services
MGS	Ministry of Government Services (now MBS)
MOC	Mid-scale On-site Composting
MOEE	Ministry of Environment and Energy
MRF	Material Recovery Facility
MSW	Municipal Solid Waste
N	Nitrogen
NGO	Non-Government Organization
NIMBY	Not In My Backyard!

OAFB	Ontario Association of Food Banks
OALA	Ontario Association of Landscape Architects
OAPPA	Ontario Association of Physical Plant Administrators
OEN	Ontario Environment Network
OETC	Ontario Environmental Training Consortium
OFA	Ontario Federation of Agriculture
OFL	Ontario Federation of Labour
OFPA	Ontario Food Processors Association
OGSA	Ontario Golf Superintendents Association
OHA	Ontario Hospital Association
OMAFRA	Ontario Ministry of Agriculture, Food and Rural Affairs (formerly OMAF)
OMMRI	OMMRI: Corporations in Support of Recycling
OPA	Ontario Parks Association
OPMA	Ontario Produce Marketing Association
ORA	Ontario Restaurant Association
ORCA	Organic Reclamation and Composting Association
OSCIA	Ontario Soil and Crop Improvement Association
OWE	Ontario Waste Exchange
OWMA	Ontario Waste Management Association
OWRA	Ontario Water Resources Act
P	Phosphorus
PACS	Public Affairs and Communications Services (MOEE)
PAWS	Passively Aerated Windrow System
PPEC	Paper and Paperboard Packaging Environmental Council
PPO	Pollution Prevention Office
QSRC	Quick Service Restaurant Council
RCO	Recycling Council of Ontario
RCMA	Residential Composter Manufacturers Association
RDF	Refuse-Derived Fuel
STEWWR	Strategy Team for Wet Waste Reduction
SWUC	Sludge Waste Utilization Committee
TFIO	The Fertilizer Institute of Ontario
TFPC	Toronto Food Policy Council
3Rs	Reduce, Reuse and Recycle
UFCW	United Food and Commercial Workers
WMB	Waste Management Branch (MOEE)
WRAC	Waste Reduction Action Committee
WRB	Waste Reduction Branch (MOEE, formerly WRO)
WRO	Waste Reduction Office (MOEE, now WRB)
WW	Wet Waste
YIMBY	Yes, In My Backyard!

APPENDIX B
GLOSSARY OF COMPOSTING TERMS

3Rs Regulations
The 3Rs Regulations are designed to ensure that industrial, commercial and institutional (IC&I) sectors, as well as municipalities, develop programs to reduce the amount of valuable resources going to disposal.
The five new regulations, made under the "Environmental Protection Act", are:

Ontario Regulation 101/94:	Recycling and Composting of Municipal Waste
Ontario Regulation 102/94:	Waste Audits and Waste Reduction Workplans
Ontario Regulation 103/94:	Industrial, Commercial and Institutional Source Separation Programs
Ontario Regulation 104/94:	Packaging Audits and Packaging Reduction Workplans
Ontario Regulation 105/94:	Definitions (Amendments to Regulation 347)

Aerated Static Pile
A static compost pile or windrow is constructed over a grid of perforated piping and a layer of bulking agent (such as wood chips) and/or finished compost. Fans are used to force (inject) or drawn (induct) air into the pile and support aerobic decomposition. The pile may be topped with another layer of finished compost to degrade odorous compounds and to provide insulation thereby maintaining a temperature adequate to destroy pathogens.

Aerobic Composting
The bacterial decomposition of wet wastes in the presence of oxygen.

Agricultural Waste
According to the Environmental Protection Act, Agricultural Waste means: "poultry and livestock manure, or residual materials in liquid or solid form generated in the production and marketing of poultry, livestock, fur bearing animals, and their products, provided that such agricultural wastes are not hazardous. Includes the residual materials, generated in producing, harvesting, and marketing of all agricultural, horticultural and silvicultural crops or commodities grown on what are usually recognized and accepted as farms, forests, or other agricultural lands."

Anaerobic Digestion
Biological decomposition that occurs in the absence of oxygen. The biological process is two stage. Stage one reduces available substrate to organic acids. In stage two methane producing bacteria convert the organic acids into methane (CH_4), carbon dioxide and a semi-stable residue consisting of undecomposed substrate and biomass. The biological process occur at temperatures in the mesophyllic range. See also Biogasification.

Animal Bedding
Certain paper wastes have the potential for use as animal bedding.

Animal Feed
Certain by-products from food processing or the food service sector can be used to supply or supplement animal feed. Pre-processing of the food materials (which may involve drying, milling, mixing and cooking) may be required for certain feed applications.

Backyard Composting (BYC)
Residential kitchen wastes, leaf and yard wastes may be composted in home-made or commercially available compost units.

Biodegradable
Organic materials, such as paper, food scraps, leather, natural cloth fibres, grass clippings, wood, etc., that can be broken down by naturally-occurring bacteria and other microorganisms, usually in the presence of moisture and oxygen, into simple, stable compounds such as carbon dioxide and water.

Biogasification
The biological decomposition of organic matter in a closed vessel under anaerobic conditions to produce methane (which can be burned as fuel on-site or used to produce methanol), carbon dioxide, hydrogen sulphide, nitrogen, water, and a wet organic residue which requires additional treatment. Widely used in sewage, industrial wastewater and agricultural waste treatment. Also see Methanol Production.

Biological Hazardous Wastes
Any waste substance of human or animal origin (other than food wastes) which might harbour or transmit pathogenic organisms. These include, but are not limited to, pathological specimens such as tissues, blood elements, excreta, secretions, bandages, and related substances.

Biomedical Waste
Waste that includes anatomical waste, pathological waste, infectious waste, hazardous waste, and other waste generated in health care facilities and medical laboratories that requires special handling.

Biotreatment
Living organisms, such as bacteria, algae, fungi and/or microscopic organisms, are used to stabilize, adsorb, alter or break down organic wastes into carbon dioxide, water, and other simple molecules. Composters, direct land application facilities and sewage treatment plants rely on biological treatment processes.

Blue Box
More than 3 million Ontario households have been supplied with distinctive curbside collection containers (blue or green boxes or bags made of recycled plastic). The types of materials being collected vary according to the municipality and may include glass jars and bottles, aluminum and other cans, newsprint and cardboard, PET bottles, rigid plastic bottles, plastic film and polystyrene.

By-Product
A material produced during the manufacturing process, in addition to the main product.

Castings
See Worm Castings.

Centralized Composting
Organic wastes from residential and/or IC&I sources are collected and transported off-site to large central composting facilities.

Certificate of Approval (CofA)
A legal document issued by the MOEE that is required for the operation of any waste management facility under the Environmental Protection Act.

Collection
The act of picking up materials at residences, businesses or industrial sites and hauling them to a transfer station, recycling centre, composting facility, landfill or other site.

Community Composting
A number of residents within a community jointly compost their wastes under group direction and management.

Community Gardening
Utilizing available land, usually within an urban area, for the purpose of providing individual garden plots to community members to be managed as a garden by a community group.

Compost
A stable material, high in organic matter content, which is the product of an aerobic composting process. Compost is suitable for use as a soil conditioner and can improve soil structure, water retention, aeration, erosion control and other soil properties.

Compost Product
The provincial "Guidelines for the Production and Use of Aerobic Compost in Ontario, November 1991" include limits for 11 metals, PCB's and non-biodegradable particulate

matter in finished compost. Compost that has contaminant levels below the specified limits is deemed to be a "product" and not a "waste". As a product, its use is not regulated by the EPA.

Composting

"Composting" is defined as "the treatment of material by aerobic decomposition of organic matter by bacterial action for the production of stabilized humus." The environment of the compost pile (including moisture, temperature, C:N ratio, pH, aeration, volume and nutrient levels) may be maintained and adjusted to encourage the biodegradation of organic wastes by aerobic microorganisms. Currently used methods include: aerated static pile, static pile, in-vessel, and turned windrow composting. A variety of composter sizes and configurations are available, both 'build-it-yourself' and commercial models, tailored to the type and sources of organic wastes. These include: balcony and backyard-scale composters; mid-scale, on-site composters; and large central composting facilities.

Most organic materials, including sewage sludge, yard and leaf wastes, residential and IC&I food wastes may be composted. Dilute liquid wastes may need to be mixed with a bulking agent to reduce the moisture content and improve their manageability. Composting has also been used to treat contaminated soils, pesticides, tars and industrial sludges. Also see Aerated Static Pile, In-Vessel Composting, and Windrows.

Contaminant

According to the Environmental Protection Act, "contaminant" is defined as "any solid, liquid, gas, odour, heat, sound, vibration, radiation or combination of any of them resulting directly or indirectly from human activities that may cause an adverse effect." In turn, an "adverse effect" means "one of more of: (i) impairment of the quality of the natural environment for any use that can be made of it, (ii) injury or damage to property or to plant or animal life, (iii) harm or material discomfort to any person, (iv) an adverse affect on the health of any person, (v) impairment of the safety of any person, (vi) rendering any property or plant or animal life unfit for use by man, (vii) loss of enjoyment of normal use of property, and (viii) interference with the normal conduct of business."

In the context of composting, contaminants often refer to foreign materials (such as dirt, heavy metals, plastic scraps, etc.) that make it more difficult to recycle wet waste feedstocks, or reduce the value/use of the final compost or derived materials.

Controlled Compost

"Controlled Compost" is defined by Ontario Reg. 101/94 (one of the 3Rs regulations) as compost produced from leaf and yard waste composting sites that satisfies quality criteria for use in urban areas but does not satisfy criteria for compost product. Ontario Reg. 101/94 provides for a streamlined approval process for the use of controlled compost within urban areas.

Decomposers
The aerobic decomposition of wet and other organic wastes is undertaken by bacteria, fungi and other microscopic organisms (which, in the process of metabolizing organic materials, break them down into simpler chemical structures), as well as mites, sowbugs, worms and other larger organisms. They are all part of the complex food chain.
Sunlight, heat, the mechanical action of wind or water, or chemical reactions may also cause a material to decompose or otherwise break down into smaller parts or simpler molecules.

Dewatering
A physical process which removes some of the water from sludge so that its physical form is changed from a fluid to a slurry or damp solid. Dewatering processes include draining, evaporation, pressing, centrifugation, rolling and/or acid flotation, with or without heat.

Digestion
The process by which organic or volatile matter is gasified, liquefied, mineralized, and/or converted into more stable organic matter through the actions of living organisms.

Direct Land Application (DLA)
The practice of incorporating into agricultural and other lands to improve soil properties and fertility. In some cases, the waste materials are stored temporarily before spreading or being worked into the upper 15-20 centimetres of the soil. Naturally-occurring soil microorganisms break down the organic materials. Suitable organic wastes include treated sewage sludge, leaf and yard wastes, culled fruits and vegetables, dairy and poultry wastes, food processing wastes, and wood, pulp and paper wastes. DLA sites are regulated by the MOEE as "Organic Soil Conditioning Sites."

Disinfection
The destruction, inactivation or removal of those organisms likely to cause infection. Chlorination is the disinfection method commonly employed in sewage treatment.

Disposal
Disposal involves releasing back into the environment, albeit in a controlled manner, liquid, solid or gaseous wastes, and the residues of waste management processes. Landfilling has been the traditional method of disposing of municipal solid wastes. Currently, the bulk of Ontario's residential and IC&I wet wastes are being landfilled. Most liquid industrial wastes and residential sewage are discharged to municipal sewers for biological treatment prior to direct discharge to rivers or lakes. Some wastes are burned in on-site or commercial incinerators, with the off-gases released

to the atmosphere and the solid residues landfilled. Deep well disposal, land farming, ocean dumping, and direct discharge to land/air/surface water have also been utilized, but to a lesser extent. Environmental concerns about the effects of toxic leachates and off-gases have limited the disposal options for many wastes unless they are pretreated. Pretreatment may involve mixing, immobilization, detoxification and/or volume reduction. Long-term storage (either above or below ground) may be thought of as a retrievable disposal technique.

Disposal Facility
A facility or part of a facility at which waste is intentionally placed, and at which waste will remain after closure. Landfills, landfarms or lakefills are all examples of disposal facilities.

Distillation
The process of heating a liquid to its boiling point, and collecting and condensing the resulting vapour.

Diversion
Using the 3Rs of waste management as part of a strategy to keep materials from going to disposal.

Endotoxin
Toxic substances found as part of some bacterial cells and released when the cell disintegrates.

Energy From Waste (EFW)
Burning waste in an incinerator and using the heat released to make steam or generate electricity.

Environment
The most comprehensive definition of "environment" is contained in the Ontario Environmental Assessment Act: "(i) air, land or water; (ii) plant and animal life, including man; (iii) the social, economic and cultural conditions that influence the life of man or a community; (iv) any building, structure, machine or other device or thing made by man; (v) any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from the activities of man; or (vi) any part or combination of the foregoing and the interrelationships between any two or more of them, in or of Ontario."

Environmental Assessment
A detailed study of a proposed project which includes: an assessment of the need for the project, various alternatives to the project, potential social and environmental impacts, methods to reduce the potential for any negative impacts, monitoring techniques, and methods to remediate any problems that do occur.

Environmental Assessment Act (EAA)
The primary piece of legislation that provides the environmental assessment of provincial, municipal and certain private sector projects in Ontario.

Environmental Protection Act (EPA)
The primary piece of legislation that provides the basis for the control and regulation of environmental pollution of both air and water in Ontario. Part V of the EPA is concerned with waste management.

Enzyme Treatment
Enzymes produced by bacterial cultures, yeast, fungi or plants are highly specific chemical catalysts that can be used to break down or detoxify synthetic and natural organics. Enzyme treatments can be implemented as part of a biological treatment process or for the in-situ bioremediation of contaminated soils and groundwaters. A number of dry enzyme powders and strains of adapted bacteria are commercially available (often in a freeze-dried form).

Ethanol Production
Ethanol (C_2H_5OH), also known as ethyl or grain alcohol, is a colourless, volatile, flammable liquid that is used as a gasoline extender (to make gasohol), an octane enhancer in fuels, a reagent in many industrial processes and in intoxicating beverages. Chemical/biological processes (hydrolysis, followed by fermentation and distillation) may be used to convert the sugars in biomass into ethanol.

Fermentation
Microorganisms (including bacteria and yeasts) are used to decompose sugars and starches to ethanol and carbon dioxide. Fermentation is used in the production of wine, beer and alcohol, bread, antibiotics, citric acid, gluconic acid and synthetic biopolymers. A great deal of research is aimed at the conversion of agricultural products (eg. grains) and other wastes (paper fibres) to ethanol and other products such as animal feed supplements.

Fertilizer
Natural or synthetic material used to add nutrients to soil. Most chemical fertilizers contain a mixture of nitrogen (N), phosphorus (P) and potassium (K). Also see Organic Fertilizer.

Garbage
See Waste.

Garburetor
A small electrical apparatus, usually attached to the kitchen sink, for grinding organic wastes before flushing them down the drain. Many waste management experts believe garburetors waste energy and water, and may place a strain on a community's

sewage treatment plant or homeowner's septic system. Much larger, industrial-scale garburetors are also available.

Gasification
The production of methane from biomass or coal. See Biogasification, Methanol Production, Thermal Conversion.

Gasohol
A blend of 10% ethanol with gasoline.

Generator
A person, business, industry or institution that creates, produces or otherwise generates wastes.

Gleaning
The process of manually collecting agricultural produce which has been missed or dropped by harvesting equipment.

Hazardous Waste
Ontario Regulation 347 defines "hazardous waste" as a: "(i) hazardous industrial waste, (ii) acute hazardous waste chemical, (iii) hazardous waste chemical, (iv) severely toxic waste, (v) ignitable waste, (vi) corrosive waste, (vii) reactive waste, (viii) radioactive waste (except radioisotope wastes disposed of in a landfilling site in accordance with written instructions of the Atomic Energy Control Board), (ix) pathological waste, (x) leachate toxic waste, or (xi) PCB waste as defined in Ontario Regulation 11/82." The term excludes radioisotope wastes, domestic wastes, ash from the incineration of domestic waste, sewage waste, agricultural waste, inert fill, and small quantities of hazardous wastes.

Hot Compost Pile
See Static Pile.

Humus
A nutrient-rich material resulting from the natural decay of organic material in the soil. Humus also binds soil particles together, improving soil structure.

IC&I Solid Waste
Industrial, Commercial and Institutional solid wastes generated by businesses and industries (including shopping centres, restaurants and offices) and institutions (such as schools, hospitals and government offices). IC&I wastes comprise approximately 60% of Ontario's total municipal solid waste stream.

Incineration
The thermal destruction of organic waste in a controlled manner, producing ash, slag,

gases and, usually, slurry from the air pollution control system.

Infectious Waste
Waste containing pathogens and consisting of tissues, organs, body parts, blood and/or body fluids that are removed during surgery.

Integrated Waste Management
The complementary use of a variety of waste management practices to safely and effectively handle municipal solid waste. Integrated waste management techniques may include source reduction, reuse, recycling, combustion and landfilling.

"Interim Guidelines for the Production and Use of Aerobic Compost in Ontario, November, 1991"
Interim Guidelines, published by the Ontario MOEE, to assist facility proponents, MOEE staff and the staff of other agencies in the selection and/or approval of appropriate aerobic composting methods and the production of quality compost based on good operating practices, compost characteristics, and current MOEE legislation. The primary objective of the Interim Guidelines is to protect human health and the environment while permitting compost production and use. The Interim Guidelines are subject to periodic revision as new information becomes available.
Finished compost which is to be transported off-site must be tested and meet the Guidelines' quality criteria if it is to be used on an unrestricted basis. Compost which does not meet the criteria is considered a "Processed Organic Waste."

In-Vessel Composting
In-vessel systems are either fully or partially enclosed. Improved mixing, automated process controls and monitoring systems are employed to maximize the composting environment (aeration, temperature and moisture conditions) and speed the process. Aerobic decomposition takes place in containers of various types, including: rotating drum systems; horizontal channels either fully or partially enclosed; vertical (silo) configurations; or batch container systems.

Landfarming
Landfarming (also known as sludge farming or land spreading) is one of the simplest biological treatment methods available, and relies on the natural assimilative capacity of the soil. It involves spraying, injecting or plowing liquid wastes/sludges into the upper 15-20 centimeters of the soil. The wastes are then adsorbed on soil particles, biodegraded by naturally occurring microorganisms, or otherwise transformed physically, chemically or biologically. Oxygen levels, moisture content, nutrients (particularly nitrogen and phosphorus) and pH conditions may be manipulated to increase the efficiency of the process. Soil characteristics also determine the success of land treatment; the soil must be sufficiently fine to hold moisture and retain contaminants. Monitoring must be carried out to ensure that the soil's assimilative capacity is not exceeded. Because of the threat of water contamination, an efficient

run-on/run-off control system is critical. Odours may also be a problem.
The technology is well developed, relying on many of the soil preparation techniques and systems commonly used in agriculture. Petrochemical wastes, sewage sludges and food processing wastes may be landfarmed, although pretreatment may be necessary to detoxify certain waste streams.

Landfill
An engineered ground facility for the burial/disposal of solid, nonhazardous wastes under controlled conditions with the objective of eliminating releases to air, groundwater or neighbouring land, and minimizing environmental nuisances or hazards to public health and safety.

Leachate
The liquid which passes through (and, on occasion, out of) a compost pile or landfill site as the result of rain and other water percolating through and picking up certain soluble waste fractions en route.

Level Playing Field
Environmental policies and programs are said to support a level playing field when they apply equally to all suppliers (both domestic and out of province) to the Ontario market and when they equitably share requirement for stewardship and environmental protection among all generators, handlers and processors.

Leaf and Yard Waste
Ontario Reg. 101/94 (one of the 3Rs regulations) defines "leaf and yard waste" as grass clippings, tree and shrub trimmings, fruits and vegetables from gardens, flowers, natural Christmas trees (evergreens) and similar organic plant materials generated from gardening and yard maintenance activities at residential and other properties. Tree limbs or other tree parts may be included in leaf and yard waste but only if they are under 7 centimetres in diameter.

Life Cycle Analysis (LCA)
A quantifiable assessment of the environmental impacts of a product/process through the stages of its life, including: the extraction of the raw materials used in its manufacture; the water, energy, and process chemicals used and the wastes produced during processing; transportation, handling, packaging and marketing; use (and reuse) of the product; and final recycling, treatment or disposal of residues.

Liquid Industrial Waste
Liquid waste as specified in Ontario Regulation 347. The slump test is used to determine whether a sludge should be considered a liquid waste under the EPA.

Manure
Animal dung and urine are valuable organic wastes that may be used to improve soil

structure and fertility. It may also be mixed with straw and composted; manure makes a good compost activator. Fresh manure is prone to leaching and may "burn" susceptible plants.

Material Recovery Facility (MRF)
A recycling site that receives mixed municipal wastes or source-separated materials such as used newsprint, fine paper, old corrugated containers, glass, ferrous, aluminum, PET and other plastics, wood, concrete and brick, and drywall. The MRF can physically remove contaminants, sort, grade, bale, grind, package and transfer the material to a recycler or end-user.

Methane Gas
Colourless, flammable gas (CH_4) commonly called marsh gas. Naturally produced when organic material biodegrades under anaerobic conditions (i.e. in the absence of oxygen). Methane may be collected at landfills and compost facilities, and either burned (to generate heat or electricity) or used to produce methanol. Methane is the main component of natural gas.

Methanol Production
Methanol (CH_3OH) is a toxic, colourless liquid that is utilized as a high-octane fuel, gasoline blend, solvent, and a chemical feedstock in a wide range of industrial processes. Also called methyl alcohol or wood alcohol, methanol is commonly derived by either a high-pressure catalytic process or the oxidation of natural gas. New technologies are being developed to process methanol directly from biomass sources (peat, wood, grass crops, etc.) or from the methane generated during anaerobic digestion. Also see Biogasification, Gasification, Pyrolysis, and Thermal Conversion.

Microorganisms
Bacteria, unicellular plants and animals, and other small organisms not visible to the naked eye.

Mid-scale On-site Composting (MOC)
A composting unit scaled to accept wet wastes from multi-unit residential buildings, businesses, institutions or other generators on contiguous or immediately adjacent properties under the control of one owner.

Mulch
A mixture of organic material, such as straw, peat moss or leaves, that is spread over soil to prevent evaporation, maintain an even soil temperature, prevent erosion, control weeds and/or enrich soil.

Municipal Sewage Sludge
A term used to describe the solids produced from the treatment of raw sewage at a

municipal sewage treatment plant or water pollution control plant. Also see Sludge.

Municipal Solid Waste (MSW)
Materials discarded by individuals in the course of their daily activities at home and by commercial businesses, industries and institutions as a result of normal operating activities. MSW is usually subdivided into Residential Waste and IC&I Solid Waste. MSW does not include liquid industrial or hazardous wastes. Also see Organic Waste, Waste, and Wet Waste.

Municipal Supply of Discards (MSD)
Some waste management experts eschew "negative" terminology, such as trash, garbage or waste in favour of a more optimistic lexion that recognizes and reinforces the resource potential of recoverable, reusable and/or recyclable materials and residues in the municipal waste stream. In the field of "wet waste" management the following terms would be favoured: grass clippings, cuttings, prunings, leaves, bush and other yard trimmings, food scraps, leftovers, peelings, culled fruits and vegetables, wood scraps, recovered paper, or bio-solids.

NIMBY
Not in my backyard! An attitude attributed to communities, residence associations or local environment groups that oppose the siting of industrial facilities, waste disposal operations, powerlines, or other projects associated with real, potential or perceived environmentally harmful impacts.

On-site/Off-site
Concerning the movement and/or treatment of wastes on or off the premises of the facility where a waste is generated. Materials generated by a number of immediately adjacent properties/facilities/housing units under the control of one owner to a central treatment facility may be considered on-site treatment. However, if such wastes must cross a public road or other property, the material is considered to be travelling off-site.

Ontario Regulation 347
Waste Management, General Regulation 347, under Ontario's Environmental Protection Act, sets out standards for solid waste disposal sites and waste management systems, and governs the handling, transport and disposal of registerable liquid industrial and hazardous wastes.

Organic Fertilizer
Generally insoluble carriers of plant food. There are three sources of organic fertilizer, all derived from natural organic matter: (1) animal manure (human manure, sometimes referred to as night soil, is not used); (2) green manure, consisting of any plants (generally leguminous) that are plowed into the soil; (3) compost; and (4) dried animal components, such as bone, blood and fish meal.

Organic Soil Conditioning Site
A site which has received approval under Ontario Regulation 347 to receive "Processed Organic Waste" as designated under the "Interim Guidelines for the Production and Use of Aerobic Compost in Ontario, November, 1991."

Organic Waste
Waste containing carbon-based compounds. The term may be used in a more restrictive sense to refer specifically to biodegradable, compostable wastes of plant or animal origin, such as food scraps, grass clippings, yard wastes, etc., but excluding lumber, plastic, rubber, oils and other hydrocarbons, and other organic chemicals. Also see Municipal Solid Waste, Waste and Wet Waste.

Paper Fibre Sludge
A term applied to the by-product of the paper recycling process consisting of solids composed of unused paper fibres and natural clay.

Part V Facility
A waste treatment operation, such as composting or filtration and solidification, which operates under a provincial Certificate of Approval (C of A) as a waste management system under Part V of the Environmental Protection Act.

Passively Aerated Windrow System (PAWS)
Static windrows of organic waste that rely on the natural diffusion of oxygen into the pile to support aerobic decomposition. Also see Aerated Static Pile, Composting, and Windrows.

Pathological Waste
As defined by Ontario Regulation 347, pathological wastes include: "(i) any part of the human body, including tissues and bodily fluids, but excluding fluids, extracted teeth, hair, nail clippings and the like, that are not infectious; (ii) any part of the carcass of an animal infected with a communicable disease or suspected by a licensed veterinary practitioner to be infected with a communicable disease; or (iii) non-anatomical waste infected with communicable disease."

Permit-By-Rule
"Permit-By-Rule" is a simplified, streamlined approvals process that utilizes a uniform set of facility design and/or operating standards or parameters. Certain types of composting projects (leaf and yard waste composting facilities, for example) may be exempted from the full EPA Part V approvals process provided they comply with such standards to the satisfaction of the MOEE.

Photodegradable Material
Material which is capable of being broken down in the presence of ultraviolet (UV) radiation from the sun or artificial sources.

Processed Organic Waste
Ontario Reg. 347 defines "Processed Organic Waste" as material that is primarily organic and has been stabilized through aerobic or anaerobic decomposition or other means. Compost that does not satisfy the criteria for compost product is a "processed organic waste". Similarly, compost from leaf and yard waste composting sites which is not either a compost product or a controlled compost is also processed organic waste.

Product Stewardship
An approach to waste management which recognizes the (moral, not to mention economic) responsibility of a manufacturer to monitor and alleviate the environmental impacts associated with the manufacture, shipment, storage, sale, use and final disposal of its products and associated packaging. This may commonly involve accepting the return of used packaging and used/unused/unwanted product.

Pulp and Paper Sludge
See Paper Fibre Sludge

Pyrolysis
A thermal process used to break down organic waste materials into volatile vapours, carbon-based residues and other materials, using heat (sometimes in the form of a molten salt or metal bath) in an oxygen-starved reaction chamber.

Recyclable
According to labelling guidelines developed by Consumer and Corporate Affairs Canada, a product or package is deemed "recyclable" where at least one-third of the population in the market where the product is sold has convenient access to collection or drop-off facilities for recycling that material. Where a material or product cannot be or is not reasonably expected to be recycled, no claim of recyclability may be made.

Recycled Content
According to labelling guidelines developed by Consumer and Corporate Affairs Canada, manufacturers must indicate the percentage (by weight) of recycled material contained in a product or package in all cases where claims of recycled content are made. Unless otherwise stated, it is assumed the recycled component is derived from post-consumer materials.

Recycling
Physical, chemical or biological processes are used to treat a waste stream (or separate/extract useful components) to produce the raw material needed to make a new product. To be successful, a recycling program requires an effective infrastructure for segregating, collecting, transporting and reprocessing the feedstock, as well as the maintenance of stable markets for the derived secondary materials.

Reduction
Reduction involves activities which decrease or eliminate the production of wastes. Industrial production changes or modified consumer practices can decrease the consumption of materials and/or the quantity of waste produced.

Refuse-Derived Fuel
See Waste-Derived Fuel.

Rendering
A process that uses hot water or steam to separate fats from protein, connective tissue and other water-insoluble materials found in animal carcasses and other food-processing wastes.

Residential Solid Waste
The waste produced by all kinds of households, including detached dwellings, row housing, condominiums and apartments. In Ontario, residential waste makes up about 40% of the total municipal solid waste stream.

Resource Recovery
Any process that extracts value from collected solid wastes (for example, through recycling, or burning wastes as fuel to generate energy).

Reuse
To use a product or package again, in its original form, for either the same or a different purpose. Reuse entails less intensive cleaning/reprocessing than is usually involved in recycling.

Secondary Waste
Wastes generated as a result of processing wastes (i.e. residues resulting from a waste recycling operation).

Sewage Sludge
See Municipal Sewage Sludge.

Sludge
Accumulated settled solids forming a semi-solid or semi-liquid waste that is generated from a municipal, commercial, or industrial treatment facility, wastewater treatment plant, or air pollution control facility. Also see Dewatering.

Slump Test
A laboratory procedure, as described in Ontario Regulation 347 under the EPA, which is designed to measure the cohesion of sludges and slurries. A waste resulting from an industrial process, manufacturing or commercial operation is classified as a liquid

industrial waste for the purposes of waste management if it has a slump of more than 150 mm. The slump test method was adopted from the cement industry and is a measure of the ability of a waste to flow.

Slurry
A pumpable mixture of solids and liquids.

Soil Amendment
Any material added to the soil in order to enhance the soil's physical or chemical properties or biological activity.

Soil Conditioner
See Soil Amendment. Also see Compost.

Solid Waste
See Municipal Solid Waste.

Solid Waste Management
The entire process of collecting, sorting, processing, recycling, reclaiming, treating and disposing of waste. The recommended waste management hierarchy begins with consideration of practicable waste reduction and reuse measures, followed by recycling, resource recovery and, finally, disposal.

Source Separation
The segregation of used materials from municipal waste into specific material categories at the point of generation in order to facilitate recycling.

Static Pile
A composting method in which suitable materials are arranged into a pile large enough that decomposition will cause temperatures to rise in the centre of the pile. Alternating layers of chopped brown organic materials (high in carbon) and green organics (high in nitrogen) are built into a pile 1-2 metres high. The action of the decomposers causes temperatures to rise in the centre of the pile, reaching an optimum of about 55°C in 4-7 days. At that point the pile may be turned (moving material from the outside to the centre), and extra water and nitrogen added, if necessary. The elevated temperature kills most weed seeds, pest larvae and pathogenic diseases. Also see Aerated Static Pile, and Windrows.

Storage
The actual or intended containment of waste on a temporary basis, in a manner which does not constitute disposal.

Thermal Conversion
See Pyrolysis.

Thermal Treatment
Process by which organic waste is rendered non-hazardous or is reduced in volume by exposing the waste to high temperatures in order to convert it to inorganic ash, water vapour, carbon dioxide and other gases. Incineration is one form of thermal treatment.

Three Rs (3Rs)
The reduction, reuse and recycling of waste.

Three-Stream Source Separation
In three-stream source separation systems, residential MSW collection entails the pickup of three containers: a "wet" container for food and yard wastes only, a "dry" container for recyclable materials (paper and cardboard, ferrous and nonferrous metals, glass, certain plastics, etc.), and a third container for non-recyclable materials (soiled food wraps, non-container glass, pottery, diapers, etc.). Also see Two-Stream Source Separation.

Tipping Fee
The amount of money charged by the operator of a transfer station or an approved waste disposal facility for receiving and managing waste. The charge may be based on either the weight or volume of the waste. Tipping fees vary widely among individual municipalities.

Toxics
Solid, liquid or gaseous substances which are harmful or poisonous on exposure.

Toxins
Harmful or poisonous substances created in or by living organisms, such as bacteria.

Transfer Station
Facility used to receive, (in some cases) sort, and temporarily store wastes and/or recyclable materials until they are shipped to another site for reprocessing or disposal.

True Cost Accounting
An accounting practice that involves recording all the costs (including the environmental and social costs) of managing the wastes generated from the use of a particular product or package. Also known as "full cost accounting", this could include, for example, energy use, transport, handling, treatment and disposal costs (including landfill siting, operation and closure expenses). The concept is closely related to the practice of "full cost accounting." The principles and methodologies of both true cost and full cost accounting are currently being refined.

Two-Stream Source Separation
In two-stream source separation systems, residential MSW collection entails the

pickup of two containers: one for wet wastes (food and yard wastes, soiled food wrappings, disposable diapers, etc.) and one for all other dry household waste materials. Recyclables are mixed with other dry wastes and recovered in a Material Recovery Facility (MRF). Also see Three-Stream Source Separation.

Turned Windrow Composting
See Windrows.

Vermicomposting
The term "vermicomposting" is a misnamer in that organic materials are not decomposed aerobically but in the digestive tracts of worms. The resulting product is worm "castings" which are stable and typically contain higher amounts of plant nutrients than aerobic compost.

Waste
According to the Environmental Protection Act, "waste" includes "ashes, garbage, refuse, domestic waste, industrial waste, or municipal refuse and other such wastes as are designated in the regulations." The following types of waste are exempted from the requirements of Regulation 347 and Part V (Waste Management) of the EPA: (i) agricultural wastes, (ii) condemned or dead animals (except those that fall with the definition of pathological waste), (iii) hauled sewage, (iv) inert fill, rock fill or mine tailings from a mine, and (v) recyclable material. Also see Municipal Solid Waste, Organic Waste and Wet Waste.

Waste-Derived Fuel (WDF)
According to Ontario Regulation 347 (as amended in September, 1992, to ban municipal waste incineration in Ontario), WDF comprises any one or combination of the following: a liquid industrial waste, a waste that comes under the small quantity exemption for liquid industrial waste, a hazardous waste, and/or a waste that comes under the small quantity exemption for hazardous waste. A WDF must meet specific fuel quality requirements and be wholly used as a fuel or fuel supplement in a combustion unit. Approximately 75% of potential WDF consists of used oil.

Waste Reduction Workplan
According to Ontario's 3Rs Regulations, under the EPA, a "waste reduction workplan" is defined as an "organized plan of work that when implemented will maximize waste diversion from disposal including a description of specific activities, timeliness, responsible parties, and expected results."

Wet/Dry Recycling
A program that involves the collection of both regular dry recyclables (such as cans, glass, PET bottles and newsprint) and wet compostables (such as food wastes and leaf and yard wastes).

Wet Waste
In the context of the report of the Steering Team for Wet Waste Reduction (STEWWR), "Wet Waste" is limited to that portion of the municipal solid waste (MSW) stream, from both residential and industrial, commercial and institutional (IC&I) sources, comprising food scraps and food processing wastes, leaf and yard wastes and other similar organic wastes of cellulosic or animal origin (but excluding agricultural wastes, municipal sewage sludges, pulp and paper sludge, hazardous wastes, biomedical, infectious and pathological wastes, and lumber). Also see Municipal Solid Waste, Organic Waste and Waste.

Windrows
Windrows are rows of organic material stacked into elongated piles with a triangular cross-section. Both turned and static windrow systems are used for composting. In the former, the windrows are periodically torn down and reconstructed or turned mechanically (the outside layer of the original windrow becoming the interior of the rebuilt windrow) in order to aerate and mix the organic wastes, speed the decomposition process, and reduce odours. Static windrows rely on the natural diffusion of oxygen into the pile, and may not comply with Ontario's Interim Guidelines for the production of aerated compost. Also see Aerated Static Pile.

Wood
According to Ontario's 3Rs Regulations, under the EPA, "wood" is defined as "lumber, tree trunks, tree branches or other wood wastes, except for particle board, that are not contaminated by glue, paint, preservatives or other materials or attached to non-wood material."

Wood Recycling Site
According to Ontario's 3Rs Regulations, under the EPA, a "wood recycling site" is defined as a "recycling site that receives source-separated wood and that removes foreign material for disposal, sorts, screens, grades, grinds or otherwise packages and transfers the source-separated material as municipal recyclable material."

Worm Castings
Worm manure: materials that have passed through the worm's digestive tract and been mixed with mucous.

Yard Waste
See Leaf and Yard Waste.

Some definitions are taken from: "Solid Waste Management: A Glossary of Terms," Ontario Ministry of Environment, Public Information Centre (Winter, 1992), "OWMC Guide to Hazardous Waste Terminology," Ontario Waste Management Corporation (1993), and the "Ontario IC&I Waste Reduction Manual," Carswell, (1993).

APPENDIX C

GROUP AND AGENCY PARTICIPANTS ON THE STRATEGY TEAM FOR WET WASTE DIVERSION

• ORGANIC WASTE GENERATORS

Residential

- Association of Municipalities of Ontario
- Consumers Association of Canada (Ontario)
- See Municipal Sector

Municipal Sector

- Metropolitan Toronto
- City of Barrie
- Region of Durham
- Halton
- Region of Peel
- Region of York
- Region of Waterloo
- Town of Markham

Industrial Commercial & Institutional

- Canadian Council of Grocery Distributors
- Canadian Federation of Independent Grocers
- Canadian Restaurant and Food Services Association
- Grocery Products Manufacturers of Canada
- Ontario Food Processors Association
- Ontario Produce Marketing Association
- Ontario Restaurant Association
- Ontario Public School Board Association
- Ontario Hospital Association
- Landscape Ontario

Other

- QUNO
- Sewage treatment plan operators

- **END USERS OF ORGANICS**

Public Sector

- Municipal Sector (see above)

Private Sector

- Landscape Ontario
- Ontario Federation of Agriculture
- Canadian Association of Food Banks
- Food Share
- Ontario Association of Food Banks
- Second Harvest

- **ORGANIC PROCESSORS (haulers, composters and land farmers)**

Haulers

- Ontario Waste Management Association
- Bartels Waste Management Ltd.
- Municipal Sector (see above)

Processors

- Compost Management Association (CCC)
- Grow-Rich Inc. (CCC)
- Scott Farms (OFA)
- Canadian Renderers Association
- Braemar Acres Ltd.

- **ASSOCIATIONS**

- Ontario Public School Board Association (OPSBA)
- Association of Municipal Recycling Coordinators (AMRC)
- Association of Municipalities of Ontario (AMO)
- OMMRI - Corporations in Support of Recycling
- Association of Local Official Health Agencies (ALOHA)

- Ontario Association of Physical Plant Administrators (OAPPA)
- The Fertilizer Institute of Ontario
- Paper and Paperboard Environmental Council (PPEC)

INTEREST GROUPS/CONSULTANTS

- Ontario Waste Exchange
- Ontario Environment Network (OEN)
- Recycling Council of Ontario (RCO)
- Composting Council of Canada (CCC)
- Residential Composter Manufacturers Association (RCMA)
- R. Cave and Associates
- Proctor & Redfern Ltd.
- Resource Integrated System (RIS)
- Master Composter
- Toronto Food Policy Council

PROVINCIAL GOVERNMENT

- Ministry of Agriculture, Food and Rural Affairs
- Management Board Secretariat
- Ministry of Community and Social Services
- Ministry of Environment and Energy

APPENDIX D
TERMS OF REFERENCE

(The Terms of Reference for the Strategy Team for Wet Waste Reduction (STEWWR) were distributed prior to the team's inaugural meeting in February, 1992. They are presented below in the form accepted by the team.)

The Ministry of the Environment's current drive towards waste diversion through the 3Rs (reduction, reuse, recycling) is part of a larger objective of changing our consumer society to a conserver society.

In March, 1991, the Ministry created the Waste Reduction Office (WRO) to focus attention on waste diversion and to ensure that the province meets its targets of at least 25% waste diversion by 1992 and at least 50% by the year 2000.

The government cannot achieve this goal alone; all sectors of society must be involved. Thus, we are establishing Strategy Teams (STs), so that those who will effect and be affected by this shift to a conserver society, will have an opportunity to contribute to Ontario's long-term waste management policies and practices.

The following STs have either been created or are proposed. Others may be created later:

- Tires (Ontario Scrap Tire Task Force)
- Plastics
- Construction & Demolition Materials
- Paper Fibre
- Wet Wastes

The formation of the Strategy Team for Wet Waste Reduction (STEWWR) recognizes that the organic portion of the waste stream, between 20 and 40 percent, is very significant. If the province is to meet its waste diversion targets, this portion of the waste stream must be addressed.

ROLE OF THE STEWWR

The STEWWR will deal primarily with (i) food products that are suitable for human consumption; (ii) those readily biodegradable wastes which can be used to improve or maintain our natural environment by providing beneficial nutrients and/or soil amendments and so assist in animal husbandry or plant production or (iii) be used to derive biofuels.

The STEWWR will:

(1) Provide a forum to identify issues, concerns and solutions for environmentally and economically sustainable wet waste management systems;
(2) Create a spirit of cooperation among stakeholders to further 3Rs solutions;
(3) Develop effective communications among stakeholders so that they can identify and address key issues, provide information, make recommendations and propose actions.

The STEWWR will address only measures for waste reduction, reuse or recycling. Reduction will be the priority approach. Incineration, landfill and other disposal activities will not be addressed unless they have an impact on the 3Rs with respect to the elimination of barriers or creation of opportunities.

Reduction includes activities which decrease or eliminate the generation of waste. For example, maximizing the original use of the wet material and minimizing what is left for disposal. An example of wet waste reduction from the perspective of a municipality would be backyard composting.

Reuse is using an item again in its same form, for the same or different purpose. Examples of wet waste reuse are food banks and second harvest type programs.

Recycling is the separation or extraction of useful materials from the waste stream to provide feedstock for the production of new products. Examples of wet waste recycling would be the production of animal feed or bedding, the direct application of wastes to agricultural land, central composting, backyard composting, vermicomposting, and biofuel production.

The STEWWR will be asked to address long-term objectives and to develop concepts and action plans. The groups will be kept informed about existing activities, such as issues concerning the Greater Toronto Area or the Ministry's Waste Reduction Action Plan (WRAP).

ROLE OF THE STEWWR PARTICIPANTS

The WRO's mandate includes consulting and involving stakeholders to achieve provincial 3Rs program and policy development objectives.

WRO staff will participate as STEWWR members and will facilitate, co-ordinate and otherwise support the functioning of the team or any one of its Specialty Groups (e.g. Animal Products, Composting, Direct Land Application, Biofuels, Reuse).

STEWWR members from other agencies and stakeholder groups will participate in meetings, provide input on issues and advise the WRO.

HOW THE STEWWR WILL FUNCTION

There will be one main group and several specialty groups. The main group will be multi-stakeholder and include individuals from the WRO, non-governmental organizations (environmental groups, organized labour, consumer associations), industry, and others.

The groups will attempt to reach consensus on wet waste issues. If consensus is not possible then consensus mapping, within the multi-stakeholder group, will be carried out.

The specialty groups will focus on specific issues and report back to the main group. In order to provide some structure to the discussions it is recommended that the groups use the attached Focus Chart.

The main STEWWR will meet regularly, every eight to ten weeks; specialty groups will meet as frequently as they feel necessary, in between the main team meetings.

Membership will be determined in accordance with the criteria in (the attached) Appendix.

Initially, we propose six specialty groups:

(1) Animal Products
(2) Direct Land Application
(3) Backyard Composting
(4) Central Composting
(5) Biofuels
(6) Primary Use

Specialty groups may be disbanded or created according to need.

Terms of Reference Appendix

STAKEHOLDERS/ROLES

GENERATORS

- residential single family generators
- residential multi-unit dwelling generators
- commercial generators (restaurants, distributors, etc.)
- institutional generators (hospitals, prisons, etc.)
- industrial generators (food processing., paper mills, etc.)

- municipal generators (STPs, leaf collections, etc.)
- horticultural/nurseries/landscapers
- agricultural generators (animal and vegetable farms)

COLLECTORS

- municipal waste collectors
- private waste haulers

PROCESSORS (OPERATORS)

- municipal
- private

END-USERS

- agricultural
- residential
- commercial/industrial subdivisions
- parks/golf courses/turf farms
- horticultural/nurseries/landscapers
- land reclamation

REGULATORS

- federal
- provincial
- municipal

OTHERS

- labour groups
- environmental groups
- consumer groups

LETTER OF INVITATION TO STAKEHOLDERS

January 8, 1992

In March 1991 the Ministry of the Environment restructured its organization and created the Waste Reduction Office (WRO). The mission of the WRO is to establish a leadership position in the province and to make the 3Rs a way of life, by working cooperatively with all stakeholders, as a first step in our move from a consumer to a conserver society.

Part of our focus is on waste diversion to help ensure that the province diverts at least 25 percent of its waste by 1992 and at least 50 percent by the year 2000.

The WRO and government in general cannot achieve this in isolation; all sectors of society must be involved. The Strategy Teams (STs) we are establishing will give stakeholders an opportunity to contribute to the long term waste management policies and practices which will affect their day-to-day activities.

Your organization is a key stakeholder in the "wet waste" sector and therefore, I am asking it to appoint a member to our Strategy Team for Wet Waste Reduction (STEWWR). I have enclosed a copy of its terms of reference to inform you about its scope and objectives.

Please confirm your Association's participation and nominate your representative and alternate representative to Mr. Brendan Killackey, who will chair and arrange the initial meeting of the STEWWR. A tentative date for this meeting is Tuesday, January 28, 1992 in Toronto.

We look forward to your organization's input to help develop Ontario's future waste management policies.

Drew Blackwell
Assistant Deputy Minister

APPENDIX E:
SUPPORTING INFORMATION FOR FIGURES 2, 3, 4, 5, 7

RESIDENTIAL ORGANICS, CURRENT GENERATION AND MANAGEMENT PRACTICES

Generation and Composition:

Residential MSW Generation rate: 422 kg/capita/yr

Taken from, "Physical and Economic Dimensions of Municipal Solid Waste Management in Ontario", 1991. Figure is based on pre-3Rs quantities for 1989 and includes leaf and yard waste.

Table E1: Residential MSW Composition:

Material	1989 Quantity (t/yr)	% of Total (Residential)
Paper	1,474,000	36
Glass	291,200	7
Tinplate steel	232,800	6
Aluminum	31,100	1
Plastic	252,200	6
Organic	1,279,000	32
Wood Waste/C&D	110,300	3
Other	382,600	9
Total	4,053,200	100

Ibid.

Composition of Residential Organics: 51.2% Leaf and Yard, 48.8% Food

Taken from, "Market Assessment of 3R's Activities in Ontario",1993.

Land Application:

Presumably, no residential food waste is currently being applied to land.
Some leaf and yard waste, particularly collected leaves is being applied to land. No data exists however, because this practice is not currently widespread. Total

quantities are estimated to be < 10,000 t/y.

Backyard Composting:

Approximately 700,000 BYC units distributed by end of 1993 (3Rs funding program records). It is assumed that 600,000 households were composting at end of 1993.

Diversion rate per household is taken as 240 kg/y. Total annual diversion rate is therefore = 144,000 t.

As presented in "Market Assessment of 3Rs Activities in Ontario", composition of diverted waste is assumed to be made up of 25% leaf and yard waste and 75% food waste (derived from Durham BYC demo).
Annual diversion by material is therefore:
Leaf and yard = 36,000 t
Food = 108,000 t

On-Site Composting:

Metro Toronto, Kingston and Waterloo have multi-residential, on-site composting programs. This activity is not widespread and total quantities are estimated to be less than 7,000 t/y. For the sake of simplicity, the composition of organics being composted by multi-residential units is taken as similar to that for home composting.

Central Composting:

A WRO survey of leaf and yard waste composting sites active at the end of 1992 suggests that over 100 sites composted approx. 200,000 t. It is assumed that this quantity did not increase significantly in 1993.

IC&I ORGANICS, CURRENT GENERATION AND MANAGEMENT PRACTICES

Generation and Composition:

Table E2: Summary of IC&I Organic Waste Generation Information

SIC Group	Sector	% Organics	Median Gen Rate. (kg/emp./day)
10	Food Industries: meat and poultry, fish products, fruit and vegetables, dairy, prepared cereal foods, vegetable oil, bakery products, sugar and confectionary, other (pasta, potato chips etc.)	60.6	14.98
11	Beverage Industries: soft drink, distillery, brewery, wine.		
27	Paper and Allied Products Industries: pulp and paper, roofing, paper box and bag, other converted paper products.	13.4	5.13
31	Machinery Industries:	2.7	3.21
40 - 44	Construction	1.9	0.29
48, 70-76, 85, 86, 77, 96, 97 + 91, 92	Service Industries: finance, real estate, health services, education, amusement and rec. + Accommodation Services: hotels, motels, campgrounds Food and Beverage Service Industries: restaurants, taverns, bars.	7.1	2.3
60-65, 69	Food, Beverage and Drug Industries, Retail (incl. food stores, vending)	42.9	0.3

From: "The Physical and Economic Dimensions of Municipal Solid Waste Management in Ontario", 1991.

Table E3: Estimated Composition and Quantities of IC&I Waste, 1989.

Material	Quantity (t/yr)	% of Total IC&I
Paper (all fibres)	1,221,000	22.78
Plastics	163,000	3.04
Container Glass	282,000	5.26
Metal cans	599,000	11.17
Organics	600,000	11.19
Wood Waste	1,130,000	21.08
Tires	88,000	1.64
Other	1,278,000	23.84
Total	5,361,000	100

From: "The Physical and Economic Dimensions of Municipal Solid Waste Management in Ontario", 1991.

Unfortunately, information on the composition of the IC&I organic waste stream is limited to estimates of the relative percentages of leaf and yard waste and "food" wastes. Here "food" is taken to mean organic wastes comprised of prepared food, which was originally intended for human consumption, and products of food processing and manufacturing originally intended for human consumption and the organic byproducts of food processing and manufacturing industries.

The report "Market Assessment of 3Rs Activities in Ontario",1993, estimates that IC&I organics are comprised of 82% food and 18% leaf and yard materials.

For the purposes of this report, it is assumed that no significant changes in generation of organic waste from the IC&I sector has occurred since 1992.

Primary Use:

Based on CAFB and individual food bank information, it is estimated that 4,000 - 6,800 tonnes/year of food, which would otherwise have been disposed, is diverted through redistribution. (See Primary Use sub-group report).

Animal Feed:

The report "The Physical and Economic Dimensions of Municipal Solid Waste Management in Ontario", 1993, provides an estimate of 30,000 t/y of organic waste going directly to animal feed. There is no other data.

Rendering:

The quantity of organic waste processed by renderers is not known.

On-Site Composting:

Management Board Secretariat has established a number of on-site composting facilities in government facilities. These facilities compost leaf and yard, food and manure. The quantity of other than manure materials composted by all facilities is approx. 1,000 tonnes annually.

Central Composting:

Currently only two composting facilities in the province are licensed to accept food waste: Scott's Composting Farm in Milton, which can accept 2,000 tonnes annually (this figure may be adjusted once the outcome of the hearing is known), and the MBS facility at the Ontario Science Centre, which can receive up to 300 tonnes annually.

Some IC&I leaf and yard waste is delivered by landscaping companies to municipal and private leaf and yard facilities. Landscape Ontario estimates that members manage approximately 180,000 tonnes of leaf and yard waste annually. Of this, 48 per cent is diverted from landfill and presumably is composted or chipped for use as mulch.

SUPPORTING INFORMATION FOR FIGURE 7

Table E4: Cost information - Wet Waste Diversion Options.

Facility	Process Capacity (t/y)	Capital Cost[(i)] ($/t)	Operating Cost[(ii)] ($/t)	Reference	Comments
CENTRAL COMPOSTING FACILITIES					
In vessel	300	97.30	N/A	MBS	Developmental. IC&I food wastes (cafeteria).
In-vessel aerated agitated channel	9,000	11.54	23.09	MRSP[(v)] files	Ag-bean screenings. IC&I-wood. OCC. Revenues not included.
In-vessel agitated single channel	40,000	27.50	10	R. Cave & Assoc.	Estimated costs. Res-food. IC&I-food.
Municipal Windrow	3,550	15.46	59.43	MRSP[(v)] files	Estimated costs. Res- leaf and yard waste. IC&I-food; wood; OCC. Asphalt pad.

Facility	Process Capacity (t/y)	Capital Cost[i] ($/t)	Operating Cost[ii] ($/t)	Reference	Comments
Municipal Windrow	2,000	25.30	14.00	Cave & Assoc. Presentation "The Cost of Green Wave Recycling"	Res - leaf and yard waste.
Municipal Windrow	450	15.82	44	"Yard Waste Composition Study", ORTECH, 1993	Revenues not included.
Municipal Windrow	4,500	22.20	31		Res - leaf and yard waste. Capital Costs covers leased equipment
Municipal Windrow	1,650	35.80	110.86		Res & IC&I - leaf and yard waste; woodwaste. Located in U.S. Tipping fee and revenues recover operating expenses.
Municipal Windrow	2,500	Neg.	6.40	AMRC	Res - leaf and yard
Municipal Windrow	2,000	4.00	5.00	AMRC	Res - leaf and yard
Municipal Windrow	2,800	Neg.	19.65	AMRC	Res - leaf and yard
In-vessel channel	12,000	N/A	N/A		IC&I-food Ag- manure

Facility	Process Capacity (t/y)	Capital Cost[i] ($/t)	Operating Cost[ii] ($/t)	Reference	Comments
MID-SCALE ON-SITE COMPOSTING FACILITIES					
Guelph Correctional Centre, Guelph	144	35	65	"Composting in Ontario Government Facilities", Management Board Secretariat, 1993	Windrow
Kemptville College of Agricultural Technology, Kemptville	12	21	517		Windrow
Rideau Regional Centre, Merrickeville	115	30	25		Windrow
Huronia Regional Centre, Orillia	98	76	128		Aerated Static Pile
Oxford Regional Centre, Woodstock	47	42	265		Aerated Static Pile
St. Thomas Psychiatric Hospital, St. Thomas	175	43	72		Aerated Static Pile
Burtch Correctional Centre, Brantford	79	N/A	N/A		Windrow

Facility	Process Capacity (t/y)	Capital Cost[i] ($/t)	Operating Cost[ii] ($/t)	Reference	Comments
BACKYARD COMPOSTING					
Average for Ontario household programs	150 -240 kg/hh/yr	30 - 19	2 - 3	Estimate [iii]	
DIRECT LAND APPLICATION					
Paper mill biosolids	N/A	N/A	N/A		Op. costs include site selection, pgm mgmt, contract, analysis and reporting.
Liquid sewage sludge	88,400	.28	4.95	"Utilization of Sewage-Sludge and Other Wastes on Agricultural Lands", course curriculum, 1993	Using flotation vehicle
Liquid Sewage Sludge	78,000	.13	3.89		Irrigation method
Liquid Sewage Sludge	171,600	.09	2.76		Using travelling hose
ANIMAL FEED					
	N/A	0 - 25	[iv]		

Facility	Process Capacity (t/y)	Capital Cost[(i)] ($/t)	Operating Cost[(ii)] ($/t)	Reference	Comments
RENDERING					
Conversion of wet wastes into value added products incl. animal feed supplement, tallow.	N/A	N/A	80 - 140		Operating cost is tipping fee. Lower fees for higher value wastes, meat products, grease, oils etc. Higher tipping fees for high moisture, vegetation type wastes.

NOTES:

(i) Capital costs do not include land. Amortized over 10 years.

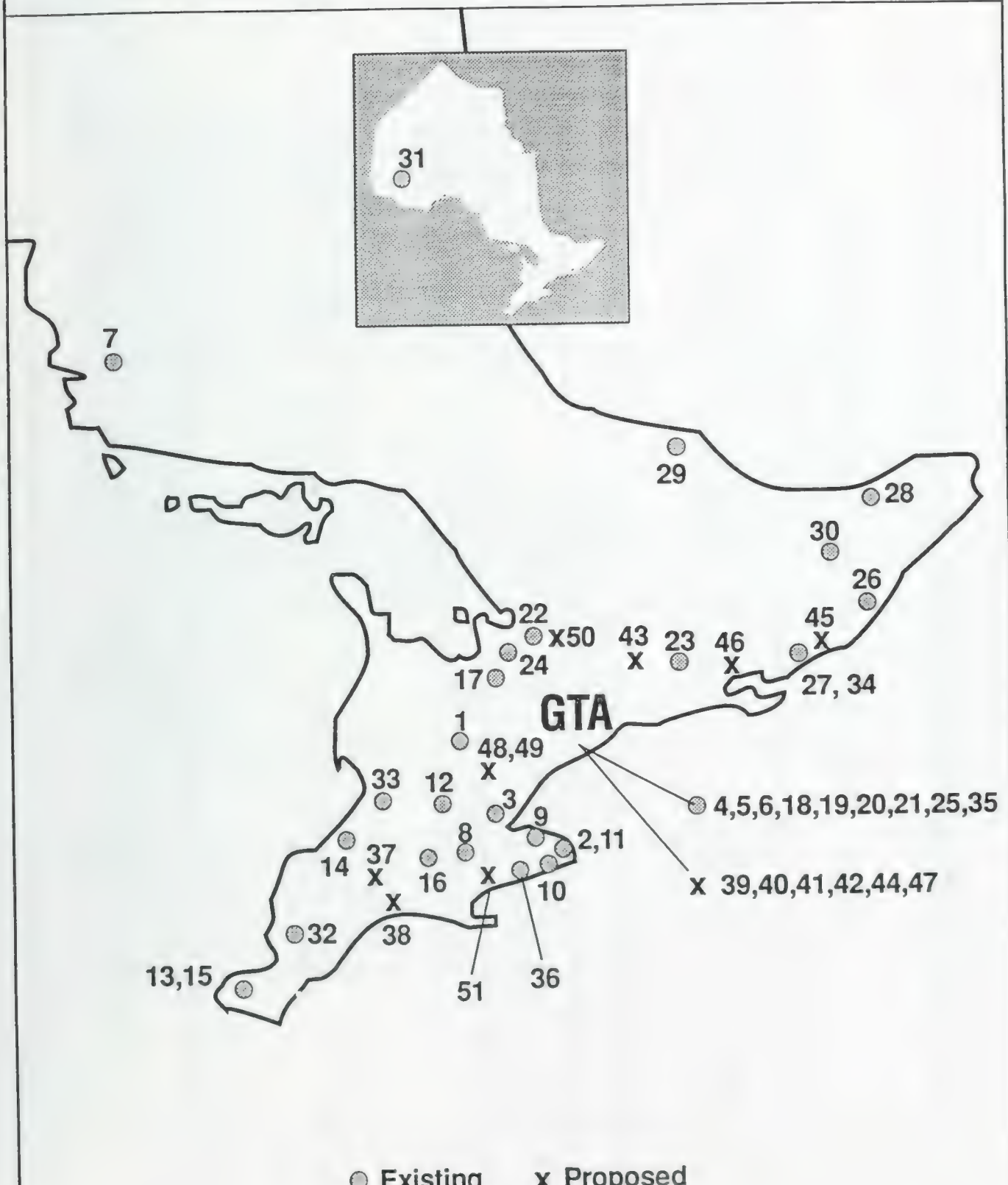
(ii) Operating costs for centralized facilities do not include collection.

(iii) Capital cost: estimate based on backyard composter cost of $45/unit (amortized over 10 years).
Operating Costs: estimated as $2 to $3/unit/yr for municipal promotion, support, monitoring.

(iv) Costs to the generator varies depending on quality (nutrition), quantity and delivered/pickup.

(v) MRSP = Municipal Recycling Support Program. This is a provincial funding program for municipal 3Rs programs.

EXISTING AND PROPOSED CENTRAL COMPOSTING FACILITIES



(Numbers refer to specific facilities listed in the following table)

APPENDIX F: THE COMPOSTING INDUSTRY IN ONTARIO

EXISTING AND PROPOSED CENTRAL COMPOSTING FACILITIES

No.	Proponent	Facility Location (City, street, landfill name etc.)	Capacity (metric tonnes/year)	Material (i) Source/Types	Process Technology	Intended End Market	Status/Estimated Start Up Date
			Existing Private Facilities				
1.	All Treats Farms	Arthur, 198 Catharine St.	170,000 t/y	◦ Res/L&Y ◦ IC&I/L&Y ◦ Ag/manures	Windrow	Sales/bulk	Operating
2.	Grow-Rich Inc.	Niagara Falls, Garner Rd.	70,000 t/y	◦ IC&I/sludge ◦ IC&I/food ◦ IC&I/wood ◦ IC&I/paper ◦ Res/L&Y	Windrow	Sales/bulk (bagged)	Operating
3.	Waterdown Gardens	Town of Flamborough, HWY 5, Lot 5. Conc. 3	690 t/y	◦ Ag/manures ◦ Ag/mushroom compost ◦ IC&I/OCC/paper ◦ IC&I/wood ◦ IC&I/food ◦ Res/L&Y	Windrow	Sales/horticulture	Operating since 1959
4.	Miller Paving	York Region	15,000 t/y	◦ Res/L&Y	Windrow	City use	Operating since 1990

No.	Proponent	Facility Location (City, street, landfill name etc.)	Capacity (metric tonnes/year)	Material (i) Source/Types	Process Technology	Intended End Market	Status/Estimated Start Up Date
5.	Sans & Sons Greenhouses	Kleinburg	80 t/y	◦ IC&I/L&Y ◦ Res/L&Y	Windrow	Horticulture	Operating
6.	Scott Farms	Milton	20,000 t/y	◦ Res/L&Y ◦ Ag/tobacco ◦ IC&I/wood	Windrow	Sales/bulk	Operating since 1991
7.	Mr. R. Lemieux	Sault Ste. Marie	2,100 t/y	◦ Res/L&Y ◦ IC&I/spent lottery tickets	Windrow	Mun. use	Operating since 1972
Existing Municipal Leaf & Yard Facilities							
NOTE: This is an incomplete listing of active municipal leaf & yard sites in Ontario. A 1992 WRB survey indicated over 100 active sites processing more than 200,000 t/y.							
8.	City of Brantford	City Landfill Site	2,500 t/y	◦ Res/L&Y	Windrow	Mun. use, residents	Operating since 1991
9.	Town of St. Catharines	Glenridge Quarry Landfill	4,000 t/y	◦ Res/L&Y	Windrow	Mun. use, residents	Operating (received CoA in Nov. 93)
10.	City of Fort Erie	Bridge St. Landfill	300-325 t/y	◦ Res/L&Y	Windrow	Mun. use, residents	Operating since 1989
11.	Niagara Falls	Mountain Rd. Landfill	200 t/y	◦ Res/L&Y	Windrow	Mun. use, residents	Operating since 1990

No.	Proponent	Facility Location (City, street, landfill name etc.)	Capacity (metric tonnes/year)	Material (i) Source/Types	Process Technology	Intended End Market	Status/Estimated Start Up Date
12.	Waterloo Region	Erb St. Landfill & Cambridge Landfill Site	4,400 t/y (combined amount, 2 sites)	◦ Res/L&Y	Windrow	Mun. use, residents	Operating at two different landfills since 1987 and 1989
13.	Essex Windsor Waste Management Association	Essex County	550 t/y (combined amount, 3 sites)	◦ Res/L&Y	Windrow	Mun. use, residents	Operating since 1990 - three different sites
14.	Town of Parkhill			◦ Res/L&Y	Windrow	Mun. use, residents	Operating since 1990
15.	City of Windsor		590 t/y	◦ Res/L&Y	Windrow	Mun. use, residents	Operating since 1989
16.	City of Woodstock			◦ Res/L&Y	Windrow	Mun. use, residents	Operating
17.	City of Barrie		300-400 t/y	◦ Res/L&Y	Windrow	Mun. use, residents	Operating since 1988
18.	City of Brampton		1,000 t/y	◦ Res/L&Y	Windrow	Mun. use, residents	Operating since 1991
19.	City of Burlington	Fidale Farms, Burlington	2,300 t/y	◦ Res/L&Y	Windrow	Mun. use, residents, ag.	
20.	Durham Region		8,000 t/y	◦ Res/L&Y	Windrow	Mun. use, residents	Operating since 1991

No.	Proponent	Facility Location (City, street, landfill name etc.)	Capacity (metric tonnes/year)	Material (i) Source/Types	Process Technology	Intended End Market	Status/Estimated Start Up Date
21.	City of Oakville			◦ Res/L&Y	Windrow	Mun. use, residents	Operating since 1989
22.	City of Orillia		600-1000 t/y	◦ Res/L&Y	Windrow	Mun. use, residents	Operating since 1992
23.	City of Peterborough		2,000 t/y	◦ Res/L&Y	Windrow	Mun. use, residents	Operating since 1990
24.	Simcoe County		1,000 t/y	◦ Res/L&Y	Windrow	Mun. use, residents	Operating
25.	Metro Toronto	Keele Valley landfill	30,400 t/y	◦ Res/L&Y	Windrow	Mun. use, residents, bulk sales	Operating since 1988
26.	City of Brockville		1,000 t/y	◦ Res/L&Y	Windrow	Mun. use	Operating since 1992
27.	City of Kingston		3,000 t/y	◦ Res/L&Y ◦ IC&I L&Y	Windrow	Residents	Operating since 1991
28.	Ottawa-Carleton Region		7,200 t/y	◦ Res/L&Y	Windrow	Mun. use, residents	Operating since 1991
29.	Town of Pembroke		500 t/y	◦ Res/L&Y	Windrow	Mun. use, residents	Operating since 1991
30.	Town of Smith Falls		327 t/y	◦ Res/L&Y	Windrow		Operating since 1992

No.	Proponent	Facility Location (City, street, landfill name etc.)	Capacity (metric tonnes/year)	Material (i) Source/Types	Process Technology	Intended End Market	Status/Estimated Start Up Date
31.	Town of Dryden		200 t/y	◦ Res/L&Y	Static pile	Mun. use, residents	Operating since 1991
Existing Municipal Government Facilities - Other than Leaf and Yard							
32.	City of Chatham			◦ Res/L&Y ◦ IC&I/sludge	Windrow	Landfill cover, residents	Operating
33.	Village of Hensall	Walton	9,000 t/y	◦ Ag/bean screenings ◦ IC&I/wood ◦ IC&I/OCC	In-vessel (aerated channel)	Sales/bulk	Operating since 1992
34.	Township of Pittsburgh		500 t/y	◦ Res/L&Y ◦ IC&I/Annatto seeds	Windrow		Operating since 1990
35.	Management Board Secretariat	Ontario Science Centre, Toronto	300 t/y	◦ IC&I/food	In-vessel	Own use	Operating since 1993
36.	Port Colborne	Elm St. Landfill Site	3000-4000 t/y	◦ Res/L&Y ◦ IC&I/mixed food ◦ IC&I/food ◦ IC&I/wood ◦ IC&I/OCC/paper ◦ IC&I/sludge	Windrow	Mun. use, residents, commercial, industrial	Operating since January 1994
Proposed Private Facilities							
37.	Advance Container Ltd.	Wellington Rd. South London	7,800 t/y	◦ Res/mixed organics ◦ IC&I/mixed organics	In-vessel (3 aerated channels)	Sales	Under construction, Nov.-Dec. 1993

No.	Proponent	Facility Location (City, street, landfill name etc.)	Capacity (metric tonnes/year)	Material (i) Source/Types	Process Technology	Intended End Market	Status/Estimated Start Up Date
38.	Tony Hermans & Associates Recycling	Aylmer	52,000 t/y	◦ Res/mixed organics ◦ IC&I/mixed organics	In-vessel	Sales	CoA received
39.	Mammone Disposal	Vaughan	1,800 t/y	◦ Res/L&Y ◦ IC&I/food ◦ IC&I/wood	In-vessel (aerated channels)	Sales, own use	CoA under review, Fall 1994
40.	Equity Management (Halton)	Halton Hills (Trafalgar Rd. & 401)	70,000 t/y	◦ IC&I/food	In-vessel (aerated channels)	Sales	Coa under review
41.	Canada Compost	Newmarket	31,200 t/y	◦ IC&I/food	In-vessel (anaerobic BTA process)	Sales	CoA approved, Fall 1994
42.	Peel Bio Conversion Inc.	Brampton	28,500 t/y	◦ IC&I/food	In-vessel (anaerobic)	Sales	CoA under review, Fall 1994
43.	Royal Paving	Mariposa Twp.	90,000 t/y	◦ Res/L&Y	Windrow	Sales	CoA under review, Fall 1994
44.	Sweda Biotech Inc.	Blackstock	70,000 t/y	◦ Ag/manures ◦ IC&I/food	In-vessel	Sales	CoA under review, Spring 1994
45.	Correctional Services Canada - Corcan	Pittsburg Twp.	12,000 t/y	◦ IC&I/food ◦ Ag/manures	In-vessel (channel)	Soil product	No CoA, under construction, Spring 1994
46.	IPS Quinte (Trenton Ont.)	City of Trenton, North East Industrial Park	18,200 t/y	◦ IC&I/food ◦ Ag/manures	In-vessel (channel)	Sales	CoA approved, Summer 1994

No.	Proponent	Facility Location (City, street, landfill name etc.)	Capacity (metric tonnes/year)	Material (i) Source/Types	Process Technology	Intended End Market	Status/Estimated Start Up Date
47.	Browning-Ferris Industries Ltd.	Mississauga	25,000 t/y	◦ IC&I/food	In-vessel	Sales	Planning
Proposed Municipal Government Facilities							
48.	Guelph	Water Pollution Control Plant	12,000 t/y	◦ IC&I/sludge ◦ IC&I/wood ◦ Res/L&Y	In-vessel (Taulman)	Land application	Under construction (30%), Summer 1994
49.	Guelph/wet dry	Pt. Lot 4 conc. 1 Guelph	50,000 t/y	◦ Res/mixed food ◦ IC&I/food	In-vessel	Mun. use, ultimately sold	CoA approved, 1995
50.	City of Orillia	Orillia	52,000 t/y	◦ Res/mixed food	In-vessel	Mun. use, ultimately sold	CoA under review, Fall 1994
51.	Northumberland County	Haldimand Twp	15,600 t/y	◦ Res/mixed food	In-vessel (aerated channels)	Sales	CoA under review, Spring 1994

NOTE:

(i) Organic materials categorized as follow:

- • by source
  - ◦ Res - residential
  - ◦ IC&I
- • by type
  - ◦ L&Y - leaf and yard
  - ◦ Mixed food - mixed processed food (eg. restaurant waste)
  - ◦ Ag - agricultural
  - ◦ Food - single type food, normally generated by food processing and grocery products manufacturing
  - ◦ Other types as indicated

EXISTING INSTITUTIONAL ON-SITE COMPOSTING FACILITIES

Proponent	Facility Location	Waste * Processed (metric tonnes/year)	Material Source/Types	Process Technology	End use of compost	Status/Start Up Date
Guelph Correctional Centre	Guelph	144 t/y	Institutional pulped food	Windrow	Facility fields	Operating since June 1991
Ridgetown College of Agricultural Technology	Ridgetown	17 t/y est.	Institutional food waste	In-vessel - batch	Facility fields	Late February 1994
Child and Parent Research Institute	London	19 t/y est.	Institutional food waste	In-vessel - batch	Grounds, landscaping	February 1994
London Psychiatric Hospital	London	64 t/y	Institutional food waste	In-vessel - continuous flow	Grounds, landscaping	January 1994
Ontario Police College	Aylmer	18 t/y est.	Institutional food waste	In-vessel - batch	Grounds, landscaping	February 1994
Kemptville College of Agricultural Technology	Kemptville	12 t/y	Institutional food waste	Windrow	Facility fields	Operating since August 1992
Rideau Correctional and Treatment Centre	Merrickville	115 t/y	Institutional food waste	Windrow	Facility fields	Operating since Winter 1992

Proponent	Facility Location	Waste * Processed (metric tonnes/year)	Material Source/Types	Process Technology	End use of compost	Status/Start Up Date
Leslie M. Frost Natural Resource Centre	Dorset	Varies	Institutional food waste	Windrow	Grounds, landscaping	Operating since June 1992
Huronia Regional Centre	Orillia	98 t/y	Institutional food waste	Aerated static pile	Grounds, landscaping, gardens	Operating since October 1992
Oxford Regional Centre	Woodstock	47 t/y	Institutional food	Aerated Static Pile	Facility fields, grounds, landscaping	Operating since May 1993
St. Thomas Psychiatric Hospital	St. Thomas	47 t/y food plus 128 t/y yard waste	IC&I food and yard waste	Aerated Static Pile	Grounds, landscaping	Operating since Spring 1992
Brockville Psychiatric Hospital	Brockville	52 t/y est.	Institutional food waste	Vermiculture	Grounds, landscaping	February 1994
Rideau Regional Centre	Smith Falls	18 t/y	Institutional food waste	Small scale vermiculture	Grounds, landscaping	Plan to expand in February 1994 to small in-vessel (est. capacity 135 t/y)
Burtch Correctional Centre	Brantford	79 t/y	Institutional food waste, yard waste	Windrow	Fields, grounds, landscaping	Fall 1993

NOTES: List is not complete but is meant to provide a sample of the projects being undertaken.

* Does not include amendments/bulking agents such as manure sawdust, peat moss, cardboard, paper and wood chips which are usually added to the food waste in a ratio of 2:1 (amendments:food).

EXISTING MULTI-RESIDENTIAL ON-SITE COMPOSTING FACILITIES

Location	Dwelling Type and No.	Management	Participation Level	Composter Type
Metro Toronto	13 housing cooperatives; mostly townhouses and low rise apartments	Volunteer	25 - 75%	3 bin
	2 rental low and high-rise apartments	Superintendent grounds staff	10 - 50%	3 bin
Waterloo	3 townhouse condominiums	Volunteer	60 - 75%	1, 2 and 3 bin
	2 rental low and high-rise apartments	Volunteer	30%	3 bin
Barrie	Various multi-unit dwellings	Individual	unknown	mostly balcony and worm bins
Markham	Private high-rise apartments	Superintendent	40%	3 bin
Thornhill	Private high-rise apartments	Superintendent	unknown	3 bin
Kingston	High-rise rental apartments	Superintendent	75%	Eco-Guardian bins

NOTE: List is not complete but is meant to provide a sample of the projects being undertaken.

APPENDIX G: SOURCES OF INFORMATION

A): INFORMATION SERVICES

Agency	Contact	Areas of Interest	Information	Services	Facilities
Recycling Council of Ontario (RCO)	Ph. 416-960-0938 Fax. 416-960-8053	- public education and promotion	- composting program directory - handbooks, manuals, videos	- information service - annual conference	- library
Association of Municipal Recycling Coordinators (AMRC)	Ph. 519-823-1990 Fax. 519-823-0084	- municipal organic waste diversion programs - information for municipalities	- municipal programs - guides, manuals, published reports	- some training	
The Composting Council (formerly SWCC) Alexandria, VA.	Ph. 703-739-2401 Fax. 703-739-2407	- quality standards - develop market for compost products - administers research program	- publications list - conference proceedings	- annual conference	- newsletter
Composting Council of Canada (CCC)	Dr. Peter Meyboom Ph. 613-238-4014 Fax. 613-238-7559	- support development of composting	- national inventory - composting research inventory - composters directory - membership directory	- annual conference	- newsletter
Stewardship Information Bureau (part of Centre for Land and Water Stewardship, Guelph)	John Kerr 519-767-5020	- environmentally sustainable farming practices - information sharing [funded by Federal Green Plan]	- manure composting - poultry composting - journal articles	- issue reviews - newsletter (Q)	- electronic database (modem access) - library

Agency	Contact	Areas of Interest	Information	Services	Facilities
Organic Reclamation and Recycling Association (ORCA) (European composting association)	Mr. Bert Lemmes Brussels, Belgium 011-32-2-722-9080	- promote development of composting - standards for compost quality	- technical publications - conference proceedings	- annual conference - newsletter	
Cornell University, Waste Management Institute Ithaca, NY, USA	Cornell University Media Services Resource Centre Ph. 607-255-2080 Fax. 607-255-9946	- Recycling, waste disposal, water and land use.	- publications list	- training course (extension program)	
Ontario Centre for Environmental Technology Advancement	1071 King St. W. Toronto, Ontario M6K 3K2 Ph. 416-345-8629	- commercialization of environmental technology by small to medium scale enterprises	- to be determined - technical, regulatory & financial services	- technology information service - business advisory service - education and training	- to be determined
Ontario Waste Exchange	Mary Jane Hanley Ph. 905-822-4111 ext. 358	- matching of waste generators with potential users	- listings of users for wet wastes	- direct assistance through telephone enquiry	- databases

B): PUBLISHED INFORMATION - Categorized by Diversion Option

Option	Title/Date	Abstract	Available From
On-Site & Home Composting	Refer to Table E: Home Composting Resource Documents Reading List		
Composting General	Composting: A Literature Study	Provides compost science, operational practices and compost systems around the world. Also contains a section on backyard composting.	MOEE
Use of Waste in Agriculture: Land Application, Animal Feed	Diverting Organic Wastes to Agriculture, November 1993	Examines the possibility of using urban waste products in agriculture.	Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)
	Fact Sheet: Commercial Compost Use in Agriculture	Outlines MOEE guidelines for compost use, provides typical nutrient values and benefits to soil structure.	OMAFRA
	Guidelines for Sewage Sludge Utilization on Agricultural Lands, October 1992	Looks at the potential impacts of sludge spreading practices on the quality of food and the environment, and the health of consumers.	OMAFRA, MOEE
	Draft Interim Guidelines for the Utilization of Waste (Other Than Sewage Sludge) on Agricultural Lands, October 1992	Outlines criteria governing the quality, use and application rates allowed for spreading waste on agricultural land.	OMAFRA, MOEE
	Guidelines to the Fertilizers Act and Regulations, April 1992	Interprets the Fertilizers Act and Regulations. Contains information on registration requirements, general labelling, and standards and tolerances for all fertilizers and supplements.	Plant Products Division, Agriculture Canada

Option	Title/Date	Abstract	Available From
	Recycling of Organic Resources in Production Agriculture	Provides technical information on the positive and negative aspects of cycling nutrients, organic matter and energy in the agri-food industry.	Soil and Water Conservation Information Bureau (Guelph)
Central Composting	Interim Guidelines for the Production and Use of Aerobic Compost in Ontario, November 1991	Outlines composting methods that produce quality compost and comply with ministry legislation.	MOEE
	AMRC Leaf and Yard Waste Composting Study, March 1993	• Part 1: A review of composting principles and municipal programs. • Part 2: A municipal operations guide. Applies information in part one for use in program management and site operations.	AMRC
	1993 North American Composters Directory, May 1993		Composting Council of Canada
	National Survey of Solid Waste Composting Operations in Canada, May 1993		Composting Council of Canada
	Proceedings of the 2nd Annual Meeting - "From Waste to Resource: Composting in a Sustainable Society", November 1992		Composting Council of Canada
	Proceedings of the 3rd Annual Meeting - "Composting: Everyone's Solution", September 1993		Composting Council of Canada
	National Survey of Solid Waste Composting Operations in Canada, May 1993 Composting Research Projects in Canada, May 1993		Composting Council of Canada

C): PUBLISHED INFORMATION - General Information by Category

Category	Title/Date	Abstract	Available From
Waste Generation and Composition	The Physical and Economic Dimensions of Municipal Solid Waste Management in Ontario, November 1991	Develops a complete picture of municipal solid waste management in Ontario for the years 1987 and 1989.	MOEE
	Market Assessment of 3Rs Activities in Ontario, January 1993	Identifies markets for secondary material recovered from the municipal solid waste stream.	MOEE
	Residential Waste Composition Study, Volume 1 of the Ontario Waste Composition Study, January 1991	Provides a cost effective method for carrying out a waste composition analysis.	MOEE
	Commercial Waste Composition Study, Volume 2 of the Ontario Waste Composition Study, January 1991	A method municipalities can use to estimate per-employee waste generation rates and the quantity of waste generated from commercial sources.	MOEE
Health & Safety	Aspergillus Fumigatus & Composting	One page fact sheet summarizing various studies' findings on the relationship between aspergillus fumigatus and composting. References cited.	US Composting Council

Category	Title/Date	Abstract	Available From
Health & Safety (cont'd)	Composting and Bioaerosols	Article provides a research review on Aspergillus fumigatus and endotoxin studies, with specific focus on their occurrence in and around composting facilities. References cited.	BioCycle (January 1994 issue)
	Composting - Health and Environmental Risks (a chapter from the book, Municipal Solid Waste Management, Making Decisions in the Face of Uncertainty)	Discusses health and environmental factors which should be considered when implementing composting initiatives.	Institute for Risk Research, University of Waterloo
	Health and Safety Precautions (Municipal Yard Waste Composting, Operator's Fact Sheet #9)	Fact Sheet on means to minimize occupational risks at yard waste recycling facilities.	Cornell Cooperative Extension
	Potential Human Health Concerns	A review of literature and facility studies on the health of workers at composting plants.	BioCycle (December 1992)
	Public Health Issues and Composting	The public health that are related to the design and operations of composting facilities are discussed.	BioCycle (August 1989)

D) PUBLISHED INFORMATION - Periodicals

Title	Subject Area	Available From
Alternatives	Examines environmental problems, related social issues and technological developments.	Faculty of Environmental Studies, University of Waterloo
BioCycle	Discusses topics ranging from municipal composting to markets and use of the end product.	JG Press Inc.
Communique	Provides updates on composting initiatives across Canada	The Composting Council of Canada
Composting News	Features news, trends and legislation in private, public and home composting.	McEntee Media Corp.
Ontario Recycling Update	Discusses issues on all aspects of recycling.	Recycling Council of Ontario
Resource Recycling	Topics covered include: composting and recycling case studies, and other waste management issues.	Resource Recycling
Waste Age	Focuses on topics ranging from international to local recycling programs.	Waste Age

E) HOME COMPOSTING RESOURCE DOCUMENTS READING LIST

The documents listed herein may be located through the Association of Municipal Recycling Coordinators (AMRC), the Recycling Council of Ontario (RCO) or the MOEE- Waste Reduction Branch. RCO printed materials are available for use in the RCO library only.

Title	Date	Author	Abstract
1991 - 1992 Worm Composting Pilot Project, Final Report	January 1993	Region of Peel	This report documents the results of a pilot vermi composter distribution and promotion program which included workshops, seminars etc. An analysis of participation, diversion, potential application to schools, offices and apartment buildings is presented.
1993 Compost Survey Report	1993	City of Peterborough	Documents results of surveys of compost unit owners.
A Survey of the Backyard Composters Distributed by the Region of Peel	February 1993	Region of Peel	This report provides results of a survey of composters distributed through the Region's 1990 and 1992 home composting programs. The survey involved household visits. The purpose of the survey was to determine the degree of sustained participation in home composting.
A Field Examination of the Cost-Effectiveness, Waste Diversion Potential, and Homeowner Acceptance of Backyard Composting Units. Phase II - The Pickering Research Project 12 Month Report	June 1992	Region of Durham	This report describes the first year findings of a study to determine the diversion potential of home composting. Intensive distribution and monitoring programs were undertaken. Diversion determined by weighing material composted and through waste composition studies. Cost effectiveness ($/tonne diverted) discussed.
Backyard Composter/Digester Participation Pilot Study: Part 1, Short Term Participation Part 2, Long Term Participation	December 1992	Region of Waterloo	This report discusses results and recommendations following free distribution of composters to 300 households using a novel distribution method. In this method, residents were required to notify the municipality if they did not want to receive a composter.
City of Mississauga's Waste Minimization Demonstration Pilot Project, Executive Summary	February 1994	City of Mississauga	This report presents the results of a three year project to compare alternative methods for diverting residential waste. Project involved several study areas in which different wet/dry collection methods and home composting were used. Results include measurements of diversion and participation in home composting.

Title	Date	Author	Abstract
Communication Strategy and Plan for the Regional Municipality of Ottawa-Carlton, Promotion and Expansion of Backyard Composting & Leaf and Yard Waste Programs	September 1993	Region of Ottawa Carlton	This document presents a communications plan for encouraging the Region's residential sector to take primary responsibility for waste reduction, specifically through composting. Part 1 of the document deals with the research, conclusions and strategy components which comprise the decision framework. Part 2 presents the communications plans, methodologies and budget.
Compost Survey Results - Summary	1994	City of Kanata	Documents results of surveys of compost unit owners.
Composting With Kids	1990	Recycling Council of Ontario	This kit has been produced to help teachers of grades four through six introduce their students to the world of composting
Earth-Works First Interim Report	April 1994 (dated Nov. '93)	City of Pt. Colborne	This report is the first from a demonstration project designed to divert the entire IC&I and residential organic waste streams. Residential program focusses on home composting and grasscycling and uses intensive education/distribution methods. A follow up program implemented using "Compost Doctors". IC&I component includes individual organic waste audits, waste characterization, collection and windrow composting.
Guide to Setting Up a Home Composting Demonstration Site	1990	Recycling Council of Ontario	This is a step-by-step guide to planning, funding, promoting and setting up a demonstration site intended to encourage homeowners to compost their kitchen and yard wastes.
Home Composting Handbook: How to Promote Home Composting in Your Community	1990	Recycling Council of Ontario	This handbook is intended to help municipal officials promote home composting in their communities. Information on how to run a public workshop and a best-composter-heap contest if given, Portable display plans, a guide to distributing bins made from used materials and funding sources for home composting projects are also provided.
How to Promote Home Composting in Your Community: Trainer's Manual	1990	Recycling Council of Ontario	A comprehensive manual that covers fundamentals of composting, explains how to educate the public effectively and how to recruit and train volunteers, and finally, discusses bin distribution and funding opportunities.
Master Composter Resource Manual	1990	Recycling Council of Ontario	This manual was designed for use in the Master Composter volunteer program organized by the RCO. It covers everything from the biology and history of composting to various units which can be built. Also included are a chapter on educational outreach which gives tips on dealing with the public and a series of appendices.

Title	Date	Author	Abstract
Metropolitan Toronto Home Composting Study	1990	Metropolitan Toronto	This study provides a follow-up evaluation of Metro Toronto's home composting program. The program was launched in March 1989 and by the spring of 1990 Metro had distributed 19,016 subsidized composting units. This study surveys participants in the program using three techniques: personal interviews, mailed questionnaires and phone follow-ups.
Model Backyard Composting Program - Summary of Results	Expected Summer '94	Recycling Council of Ont.	This report will summarize activities and results of intensive home composting programs undertaken in 9 communities in Ontario. The objective of each program was to maximize householder participation. Results in terms of participation and diversion will be presented.
Multi-Residential Composting in Ontario	May 1993	Recycling Council of Ontario	This report outlines the basic principles of on-site composting for multi-residential dwellings. Background and regulatory issues are discussed. Ontario case studies and a guide to establishing such a program are presented.
Multi-Unit Composting Demonstration Project	May 1992	City of Waterloo	This report documents implementation of on-site composting programs at 5 apartment and townhouse complexes within the City during the period June '91 to May '92. Results and recommendations for implementing similar programs are included.
Municipal Backyard Composting: Summary of Distribution Methodologies	March 1994	Association of Municipal Recycling Coordinators	This report is based onthe results of a membership survey which requested information on the method(s) employed by municipalities to distribute home composters. Both current and prior distribution methods are recorded. The document also discusses municipal experiences with the methods used and summarizes issues for consideration by municipalities considering similar approaches.
The Potential Financial Savings Incurred as a Result of Backyard Composting	February 1993	Region of Peel	This report assesses the financial savings to regional rate payers incurred through the backyard composting program. It compares cost of disposal via landfill and incineration to subsidized composter distribution and the resulting waste diversion. Costs savings projected for 10 year period between 1990-1999.
The YIMBY Program, Final Report, Maximizing Household Organic Waste Diversion through Backyard Composting	January 1994	Centre and South Hastings Recycling Board	This report documents an intensive home composting distribution and education program jointly undertaken by 15 municipalities. The project goal was to achieve 80% participation through door to door distribution of free and subsidized composters. The activities undertaken and results achieved are reported.
UNDER DEVELOPMENT			
Durham Phase III	*Expected Spring '95*	*Region of Durham*	*Project will determine degree of continued, long term participation in home composting and the factors which affect sustainability. Diversion will also be assessed.*
Markham Model Community Project	*Expected August' 95*	*Town of Markham*	